FROM MYST TO RIVEN

THE CREATIONS & INSPIRATIONS

by Richard Kadrey
Foreword by Rand & Robyn Miller

It was the end of summer 1991. Soldiers were leaving the Persian Gulf. The Soviet Union was taking its last gasp. And we had just received the funding for something that we would call *Myst*.

We had it all planned out. The name had been chosen. The story was going to be something about an island. The artwork would be hand-painted. The characters would be hand-animated. There would be no dying. There would be no "save-game" function. And the player would be the protagonist, having to rely on his or her own intuition to work through the story.

Pretty good, huh?

A few months into the project we realized that we had no idea what we were doing. Design, graphics, animations, character development, scripting, editing, sound effects, music, interactivity—it was all a mystery to us.

And this is how the creation of *Myst* became a two-year experiment. Ninety percent of our time was spent figuring out how to do things; the other ten percent was spent doing them. So, by the end of it, we were actually incredibly surprised to encounter such success. Our experiment turned into a so-called "hit," and we started thinking, "Hey, we actually know what we're doing! Let's make the sequel! It'll be easy!"

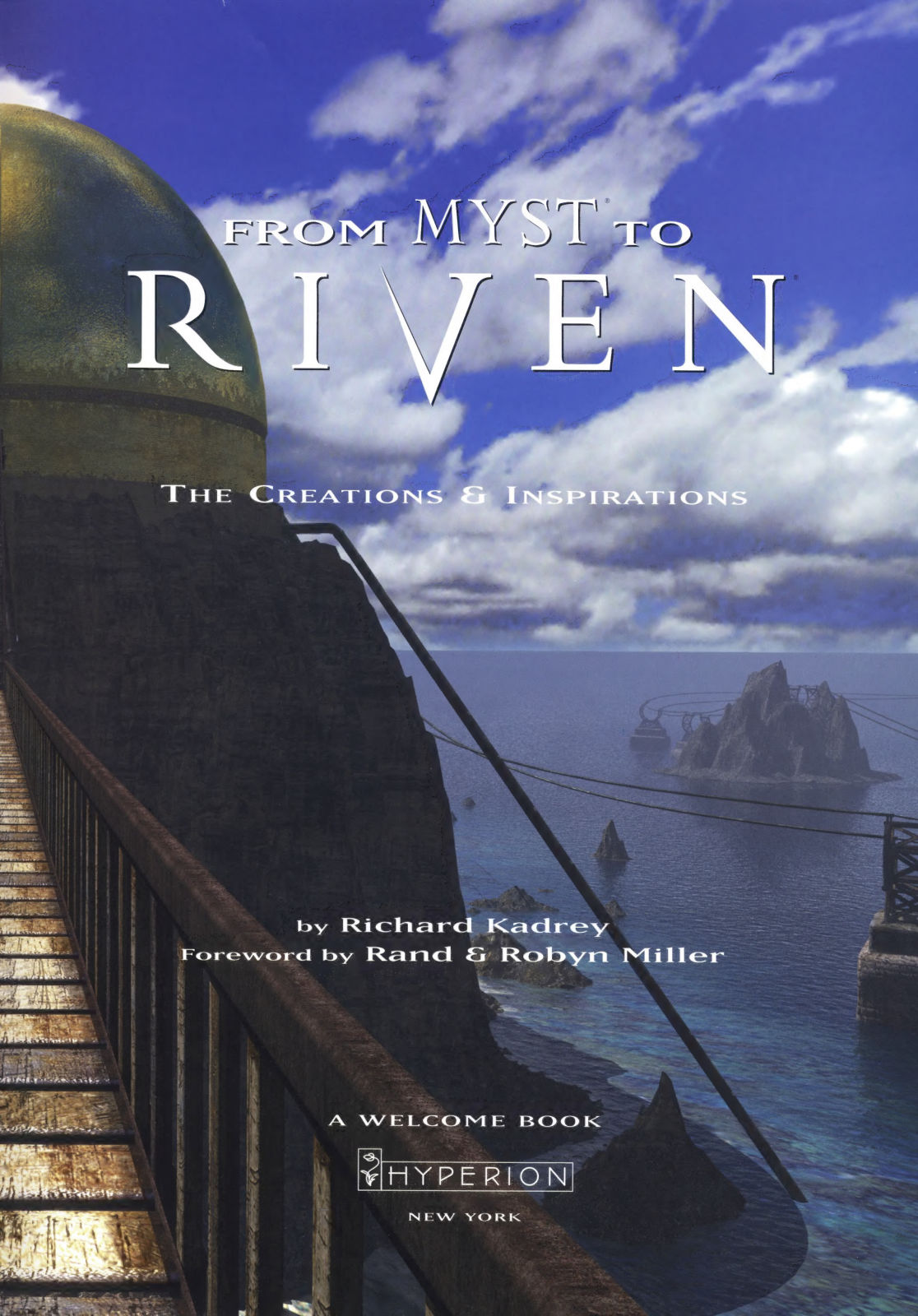
It wasn't.

Riven ended up being a mammoth undertaking, taking a team of over 20 people almost four years to produce. It has been the most grueling, yet the most thrilling, creative experience of our lives. And now, as we wrap things up, we once again begin to believe we know what we're doing. Strange.

Yet, at the same time, it becomes apparent that we are only scratching the surface of this still very undefined medium.

Rand Miller Robyn Miller Richard Vander Wende

CYAN, INC.



FROM MYST® TO RIVEN®

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by Richard Kadrey
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A WELCOME BOOK
HYPERION
NEW YORK

Acknowledgments

The producers would like to thank all the members of Cyan, Inc., for their extraordinary work to make this project happen.

We deeply appreciate the efforts of Rand Miller, Robyn Miller, and Richard Vander Wende to guide this book to its completion and for giving us their time when they had none.

Chris Brandkamp, whose knowledge, guidance, and advice was utterly indispensable, was a tower of strength. Without Chris, this book would simply not have been possible.

And to all the others at Cyan who worked on the creation of *Riven*, we express our gratitude for allowing us to share, in this way, your incredible experience.

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Produced by Welcome Enterprises, Inc.
588 Broadway, New York, NY 10012

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ISBN 0-7868-6365-X
FIRST EDITION

Printed and bound in Japan by Toppan Printing Co., Inc.

1 3 5 7 9 10 8 6 4 2

PAGE 1: In this scene from the opening of *Riven*, Atrus is played by Rand Miller.
PAGES 2-3: View of the bridge connecting Book Assembly to Temple Island and the gold super fire marble dome.
OPPOSITE: Underneath the superdome on Temple Island.

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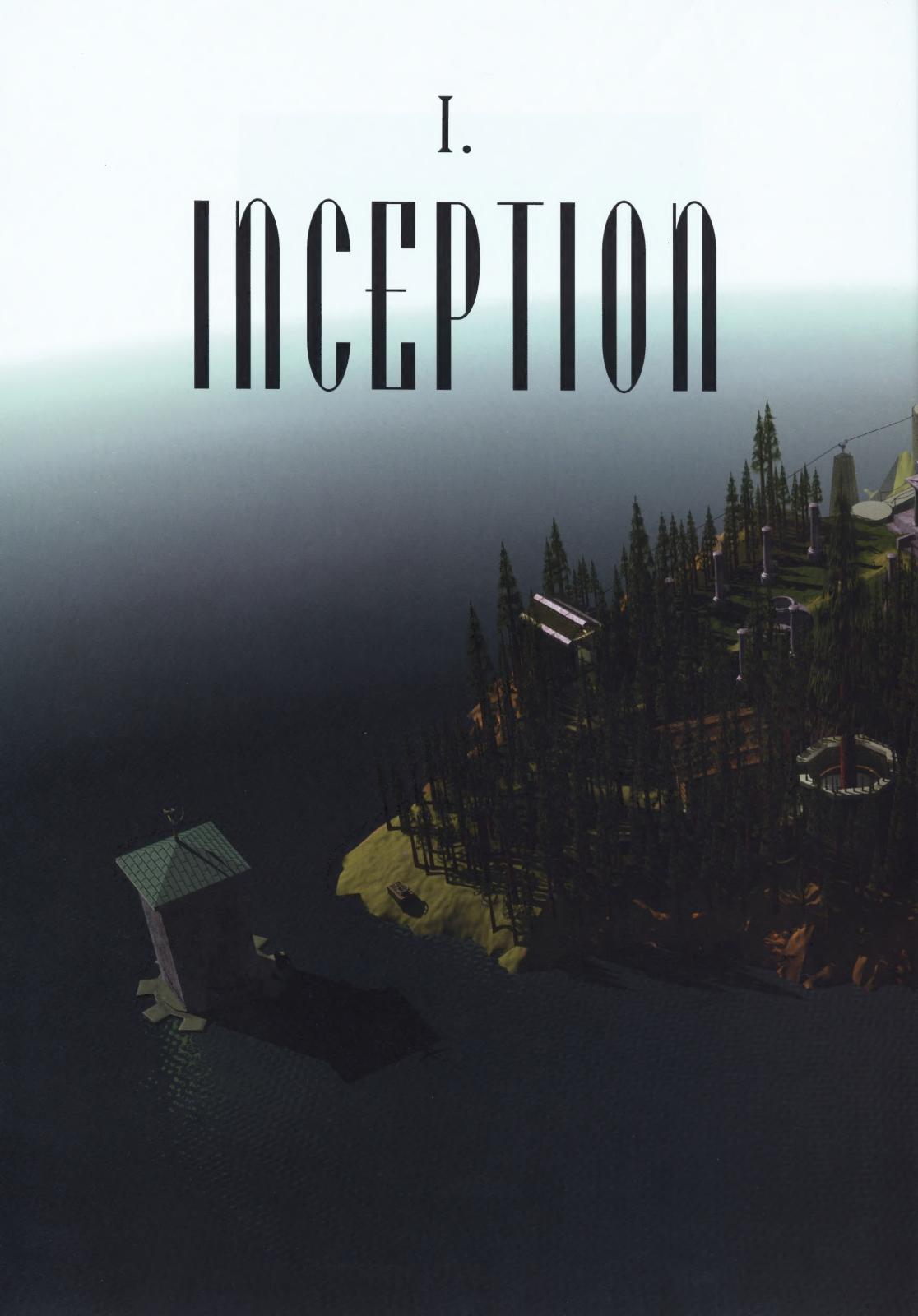
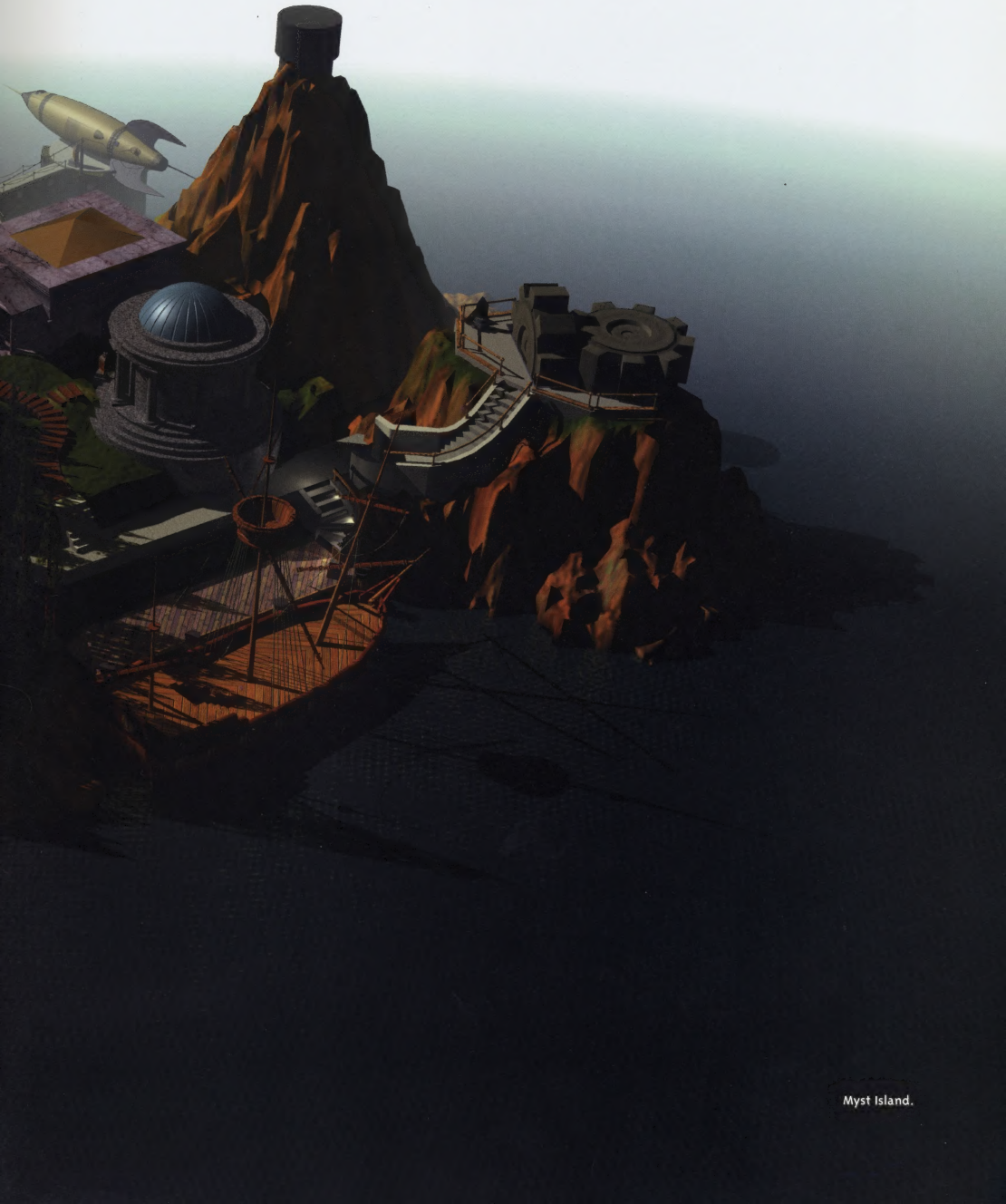
I.

INCEPTION





Myst Island.

Robyn (above left) and Rand Miller are the creators of the megahit *Myst* and its sequel, *Riven*, as well as of numerous other CD-ROM games for children. Their software company, Cyan, Inc., was established in 1987 and released its first game, *The Manhole*, the same year. This was followed by *Cosmic Osmo* in 1989 and *Spelunx* in 1991. While these games were well received, nothing could have prepared the Millers for the rocketlike success of *Myst*. For the millions who've played it, this view of the dock on Myst Island (opposite) is a familiar sight.

In the beginning

In a computer game which has sold 3.5 million copies you might expect to find the hottest action and explosions galore with heroes and villains of your choice duking it out—a diversion for kids, surely, to squander their time away.

Not so with *Myst*.

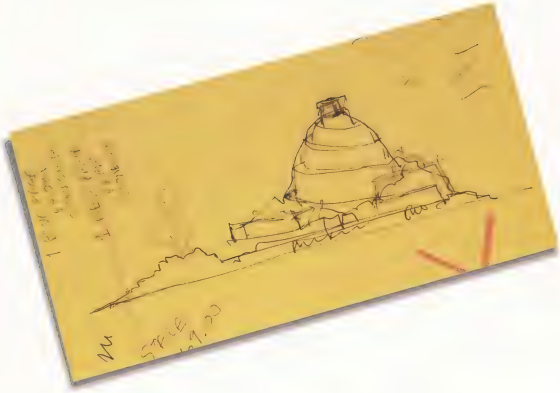
Released by Broderbund to no special fanfare in 1993, this grown-up game of exploration and deep mystery is the one true phenomenon of the CD-ROM entertainment world. It didn't just blow the doors off the competition; it peeled the paint, melted the chassis, and cut up the tires for sandals. *Myst* remains so hot that in December of 1996 it set the record for the most copies of a CD game sold in a single month—more than three years later. Winner of dozens of awards—including the Software Publishers Association's Best User Interface, Best Fantasy/Role Playing Game, and Critics Choice for Best Consumer Program—*Myst* has been acclaimed by all, including such non-techie publications as *Rolling Stone* and *Newsweek*. But more than anything else, it has been the intense buzz created by millions of fanatics consumed by the challenge of *Myst* that has turned it into the *Jurassic Park* and *Thriller* of the CD-ROM game world.

And now, Rand and Robyn Miller, the creators of *Myst*, along with new creative partner, Richard Vander Wende and a talented team of artists and programmers, have prepared to rock this world again with the release of the long-awaited sequel game: *Riven*.

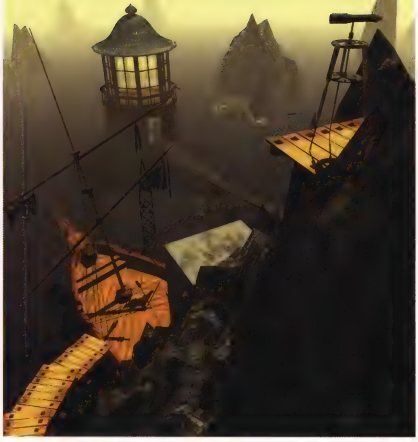
I realized the moment I fell into the fissure that the book would not be destroyed as I had planned. It continued falling into that starry expanse, of which I had only a fleeting glimpse. I have tried to speculate where it might have landed, but I must admit that such conjecture is futile.

Still, questions about whose hands might one day hold my Myst book are unsettling to me. I know my apprehensions might never be allayed, and so I close, realizing that perhaps the ending has not yet been written.

—Atrus



Robyn and Rand Miller's first ideas for *Myst* were recorded on legal pads (left) and would become the inspiration for some remarkable images, including the view of the fountain in front of Myst's library (above), as well as many unique puzzles. After noticing the toy ship submerged in the fountain, the player must first discover the related clue in the tower behind the library before he will be able to figure out which three symbols (above) to press in order to access the Stoneship Age book.



Rough sketches and handwritten notes were made for all the Ages in *Myst*, including Stoneship (above), in order to develop the mysterious character and plot of each setting. Among other places to explore in Stoneship are the lighthouse and telescope plateau (above right), the submerged ship's darkened cabin (below), and the bedroom in which the "red" page is found (bottom).

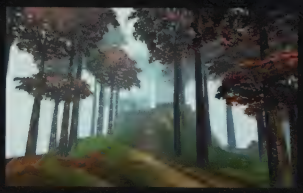
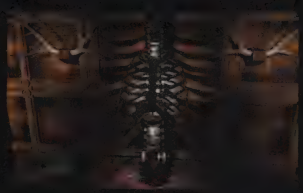
When *Myst* first appeared, it was hard to know what to make of it as a game. It was clearly something new, something no one had seen before. There were no guns in *Myst*, no overt violence, no time limit, and no scoreboard. You, the player, were literally dropped onto a strange island with no instructions and no apparent goal. There were no people, only artifacts in a weirdly beautiful landscape—a wharf harboring a sunken boat, a planetarium, a library, a spaceship, a clock tower.

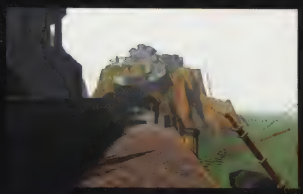
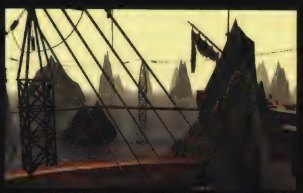
Instinctively, you asked the first questions without being prompted: Who created this island, what were all these buildings for, and why were there no people? And then you began to explore. The eerie music and sound effects that accompanied your every step only heightened the sense of mystery.

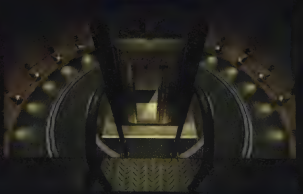
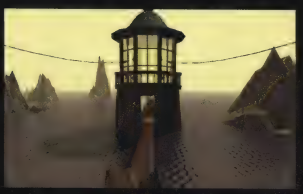
Myst was a game because it contained puzzles the player had to solve in order to learn anything about the island. It was a challenge that rewarded observation and brains over reflexes. Secrets were revealed through auditory as well as visual clues. Within *Myst*'s dreamlike structures the player came upon smaller, but equally fascinating, objects and machines with dials, levers, and buttons that all had a reason for being there, that made sense only if the player could figure them out. The computer-generated images were not meant to dazzle so much as to create a mood and offer traces of the culture of the D'ni people who, we learned later, had created and populated this place.

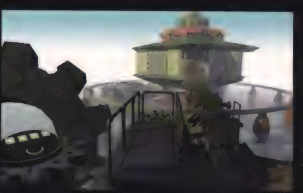
Playing *Myst* was less like hacking a computer game and more like wandering through a surrealist novel, one that didn't have a comforting linear plot and a tidy ending where everything was revealed, explained, and set right. Sure, there was a story—a complex one of family passions and betrayal—but like the baubles of this unfamiliar culture that you encountered in the game, it hinted at even more perplexing worlds hidden beyond the edges of the game.

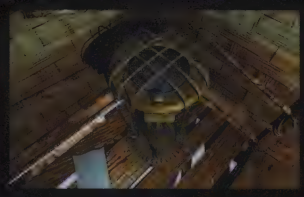
The doors to these worlds, it turned out, were the D'ni Linking books.

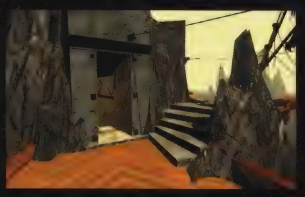



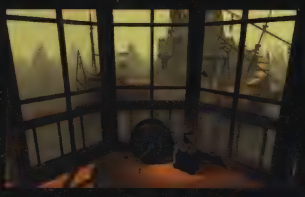
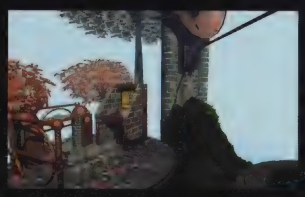
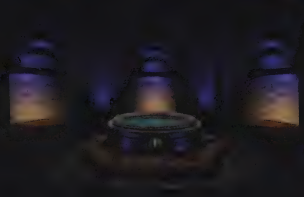



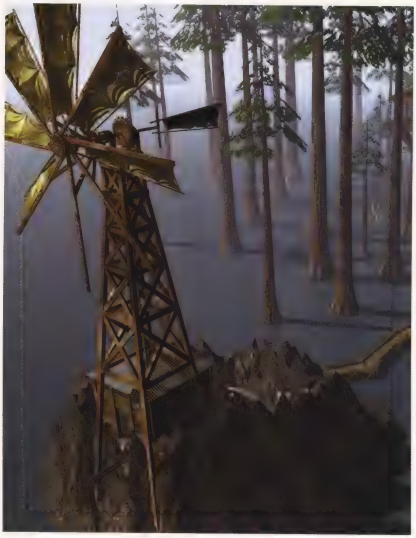






Among the original *Myst* team members, Chuck Carter (right) was responsible for creating roughly half of all of the visuals, a selection of which are seen on the preceding pages.



The sketches outlining Mechanical Age and the water pump in Channelwood Age (above) and final scenes from Mechanical, Channelwood, and Selenitic Ages (right, top to bottom).

Dividing the Ages between them, Robyn created the images for Stoneship and Channelwood Age, while Chuck Carter designed Mechanical and Selenitic Ages.

Books and the D'ni

For Rand and Robyn Miller, the D'ni civilization provided not only *Myst*'s central motif of Linking books but the entire cultural foundation upon which to build the story behind both *Myst* and, later, *Riven*. While they had already worked out the basic plot as well as the rudimentary gameplay for the first game, they had been lacking an overall vision that accounted for the existence of their imaginary island. When they learned about D'ni (pronounced *Dunny*) Linking books and understood their power to link to worlds in parallel universes, they decided to incorporate these special books into their game. Rand and Robyn knew from the beginning that the player in *Myst* would be able to visit other worlds, but early on this was accomplished through magic paintings and then, later in development, through ultraexotic machines. In the end, the D'ni Linking books offered the most elegant device, for a number of reasons, the most important of which involved the game's central figure, Atrus.

The library on Myst (above) contains mostly damaged books, except for a few that reveal important notes regarding the various Ages and clues to help the player reach them.

Building upon their discovery, the Millers collaborated with a number of others at Cyan, including Richard Watson, a programmer on *Myst*, to piece together a detailed, but fragmented, chronicle of the D'ni civilization, involving a record of some of the key events as well as their extensive language and writing system. This would eventually lead to a series of novels being written with David Wingrove that featured the life and adventures of Atrus, his father, Gehn, and grandfather, Aitrus. The books also illuminated the marvelous powers of the D'ni, particularly their skills in bookmaking.

Another original member, Chris Brandkamp (left), recorded all the sound effects which played such a crucial part in bringing the game to life.

For most people, books are sources of learning and pleasant diversions. But for the D'ni, they were an E-ticket on an inter-dimensional bullet train. They didn't just feel a connection to a world they created in writing an "Age," they could literally enter that Age by placing a hand on the "linking" page and physically transporting into it.

The D'ni Art of Bookmaking

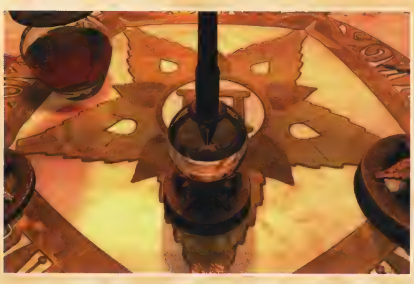
Some of the basics of D'ni bookmaking are known, but the most important details have been lost over time. "Otherwise," says Cyan programmer and D'ni historian, Richard Watson, "we'd be writing our own Ages, rather than making games." From the few existing records it appears that the D'ni have been using their Linking books for millennia, and that they linked to the Earth around 10,000 terrestrial years ago. Eight years after migrating here and establishing an underground community, the D'ni created their Book Writer's Guild. About two hundred and fifteen years later, they opened the Common Library of Complete Linking Books. But it was very recently on the D'ni timeline that Gehn began writing what would become Riven.

All that is known about the making of the books themselves is that the paper was made from a specific type of wood. The tree was cut down in a certain manner and immediately treated with chemicals. Next, the wood was finely shredded and boiled into pulp. Then, it appears the D'ni added more chemicals, along with some other form of organic fibers.

The ultimate process of how these books were made to function was closely guarded by the Bookmakers Guild. According to Watson, we can only guess at how they work, but it appears "the books are able to take advantage of the existence of quantum probabilities to link to other quantum realities."

On the desk in Gehn's Age in *Riven* (above), all the implements necessary for writing an Age book can be found. These special volumes were manufactured by the D'ni in ways known only to them. To the left is a D'ni bookpress designed by Robyn Miller.

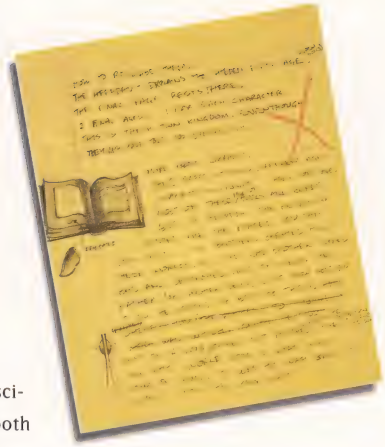
Atrus felt the skin on his palm tingle as though a faint electrical current had passed through it. His hand seemed drawn to the image on the page, attracted to it. For a moment that was all. Then, with a sudden, sickening lurch, he felt himself sucked into the page. Or rather, it was as if the page grew suddenly huge, enveloping him in the weave of its fibers.



At that same instant he felt a curious shifting sensation. It felt as though he were melting, the fragile shell of him imploding, collapsing back in upon himself, and then the blackness seeped through.

—from Myst: The Book of Atrus

A closer look at Gehn's desk reveals his golden beetle inkwell (top), his personal pen (above), and the special ingredient—in the glass jar on the right—which activates the D'ni ink (right).



The Channelwood Age book (top left) from *Myst*. Rand and Robyn's early development notes (above) regarding the Myst library and the books found there: "Many books containing different ages (Mammoth Age, Night Age, Ivory Age). Most of these page of books are burnt but 4 remain. The remaining books are the places you can still visit."

In the final moments of *Myst*, the player links to an underground room in D'ni (opposite) unless, of course, he has been duped by Atrus's deceitful sons, Sirrus and Achenar.

On the overleaf is a map discovered in Atrus's journal illustrating the path he followed from D'ni to the surface.

Age or Linking books were magic tunnels or, if you're a science fiction fan, wormholes. They could shoot you through both space and time, to any world you could imagine—and write down properly according to the strict D'ni rules and protocol. The D'ni had a handle on the multi-dimensional nature of the universe that was way beyond our own knowledge of things. They understood that for every world we knew about in our universe, there were parallel worlds, hidden in a similar universe next door. Linking books were the passkeys to those worlds.

Creating these books was no easy task. The D'ni weren't zipping all over the multiverse with notes scribbled on cocktail napkins. Learning how to make a successful Age book required years of formal training and understanding. Each part of the book—the paper, ink, and, most importantly, the words—was a separate micro-art. D'ni children studied for years and apprenticed to experts in the bookmaking arts long before they would be allowed to contemplate writing their own Age books and traveling to those worlds.

It is important to remember that D'ni Linking books didn't create worlds, they just allowed a person to go to places that already existed. When someone could write a book and link to the world of his dreams, it was very easy for him to develop a god complex, as if he were responsible for its being. This, as the first novel reveals, was Gehn's fate. In writing *Myst: The Book of Atrus*, the authors also recorded the key event that would connect the first game to the next. Atrus, we learn, was ultimately forced to trap Gehn in one of his own Age books in order to halt his father's delusions of godliness. This Age, it turns out, is Riven. It is also the place where Catherine, Atrus's wife, has been secretly confined by their rebellious sons, Sirrus and Achenar.

"But you need me, Atrus. I know so much. Things you will never know. Think of the experience I have, the knowledge. It would be a waste not to call upon it, no?"

—Gehn to Atrus

"No, Father. Whatever linked us once has been destroyed. . . . Don't you see that? Well, now you've got the justice you deserve. You can stay here in the little haven you've created for yourself, in your tiny island universe, and play god with your creations."

—Atrus to Gehn

So ends *Myst* and *Riven* begins.

Wed 1/26/94 5:34 pm
Myst II information

Father has one book which links to additional Age
—Stole it from Atrus while he moved
—Links to Dunny
—You can go there for important clue
—Age is in ruin

Goal is to get this book and to rescue Catherine and then jump into fissure

World changes as Atrus writes
—Changes can not be observed

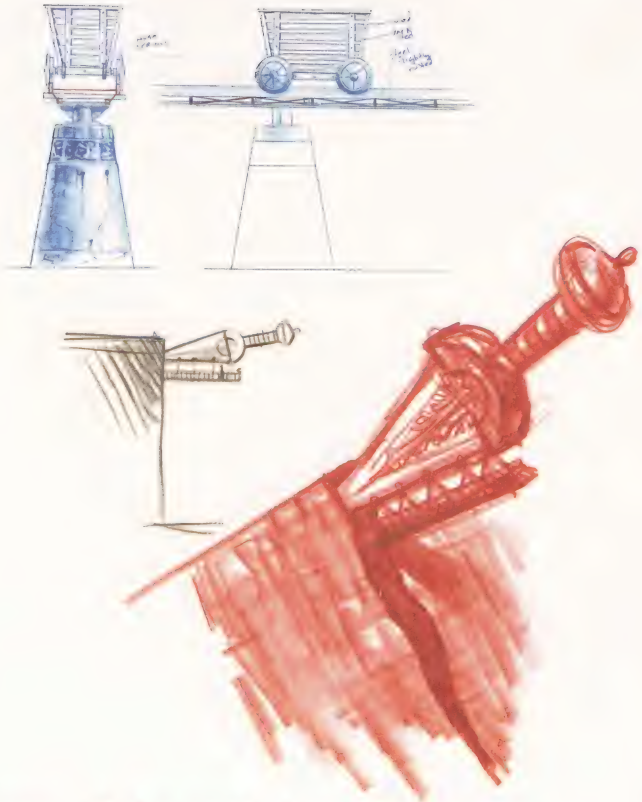
Other ages to visit
—Catherine is held prisoner in one of these other ages
—She lives in a locked cage through which you can slide her the Equiquay book
—But you'll need an Equiquay book for yourself
—Catherine can tell you that the book will be found by someone

Atrus will be writing into the book in order to aid you

Jump into chasm to go to Dunny
—Catherine would go first. Father may meet you and challenge before you jump.

Island people speak Dunny

Linking books could be written into prison cells
—Must bring key.
—Unauthorized travelers would be trapped.

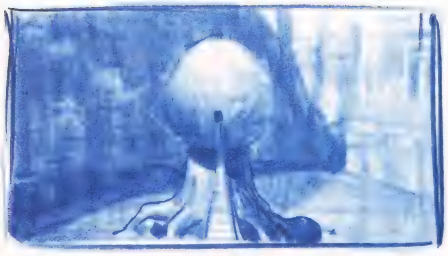


From Myst to Riven

Excerpt from Rand and Robyn's original notes on *Riven* (above) recorded during a trip to Seattle in January 1994. Rough concept sketches of the logcar ride (top), which takes the player between Book Assembly and Jungle Island, and of the huge daggers (above right) that decorate the landscape throughout Riven's world and signify Gehn's brutal reign over Riven's natural inhabitants.

Rand and Robyn's earliest notes on *Riven* date from the end of January, 1994, when they went on a road trip from Spokane to Seattle. It was during this break that they finally had a chance to begin articulating the basic details of the story for the sequel game. In the process of creating *Myst*, which had just been released the previous November, Rand and Robyn had realized that their ideas were simply far too big for a single game, so they designed *Myst* to be open-ended. *Myst*'s conclusion became more like an intermission in some larger and weirder play than an ending. It simply screamed for a sequel, which they had every intention of providing.

At this point, however, the brothers were so much more familiar with their story as well as with the process of putting together a computer game that they knew the sequel, known then simply as *Myst II*, could be much larger in scope than the original. They were reminded of the legendary British fantasy writer J. R. R. Tolkein who, after writing *The Hobbit* to great acclaim, spent years researching and developing an anthropologist's complete understanding of his fantasy kingdom, Middle Earth, before penning his massive trilogy, *Lord of the Rings*. For Robyn and Rand, *Myst* was their *Hobbit*, while



While there are many recognizable structures and objects in *Riven*, there are also some of the most imaginative and eerie images ever created, including the bulbous, podlike dome the rebels use as a hideout in their own secret Age (left).

Riven would be an opportunity to create a game of epic proportions.

Besides their desire to tell more of the story, the Millers were eager to flex all the creative and technical muscles they'd developed during the long process of building *Myst*. With greater emphasis on story development would come a more cohesive game design. On an artistic level, they would build on their skills in developing environments—coloring, texturing, lighting, and animating them—to produce a more impressive visual experience. And they would engineer a sounder game technically, avoiding, hopefully, the bugs that occasionally appeared in *Myst* (in the PC version, for example, when the sunken ship is raised, gulls fly right through the mast).

Richard Vander Wende

As *Myst* began to show signs of its phenomenal success, the Millers had every reason to pursue their dreams for the sequel. They also had more capital to support their software company, Cyan, and to hire additional people if need be. It was at a computer conference in California a few months later when the Millers encountered Richard Vander Wende, who, among other companies, had worked at Industrial Light & Magic and Disney. Richard's keen interest in *Myst* impressed Rand and Robyn, as did a portfolio of art that was breathtaking. After talking with him for three straight hours, the brothers invited Richard to visit them in Spokane. While they immediately sensed the value of adding Richard's perspective and talents to their plans for the sequel, it was important to explore a little further how their relationship would work. But after that visit, it was clear to them that he could fit right in. Once Richard agreed to join them, *Riven*'s creative team consisted of six people: Robyn, Rand, and Richard, plus Chris Brandkamp (who, in addition to being Cyan's financial officer and business manager, had recorded the sounds for *Myst*), Rich Watson and Joshua Alton Staub, the computer graphics production director. With their combined skills and the money *Myst* was pumping into the company, they figured they could knock out *Riven* in a couple of years at most.

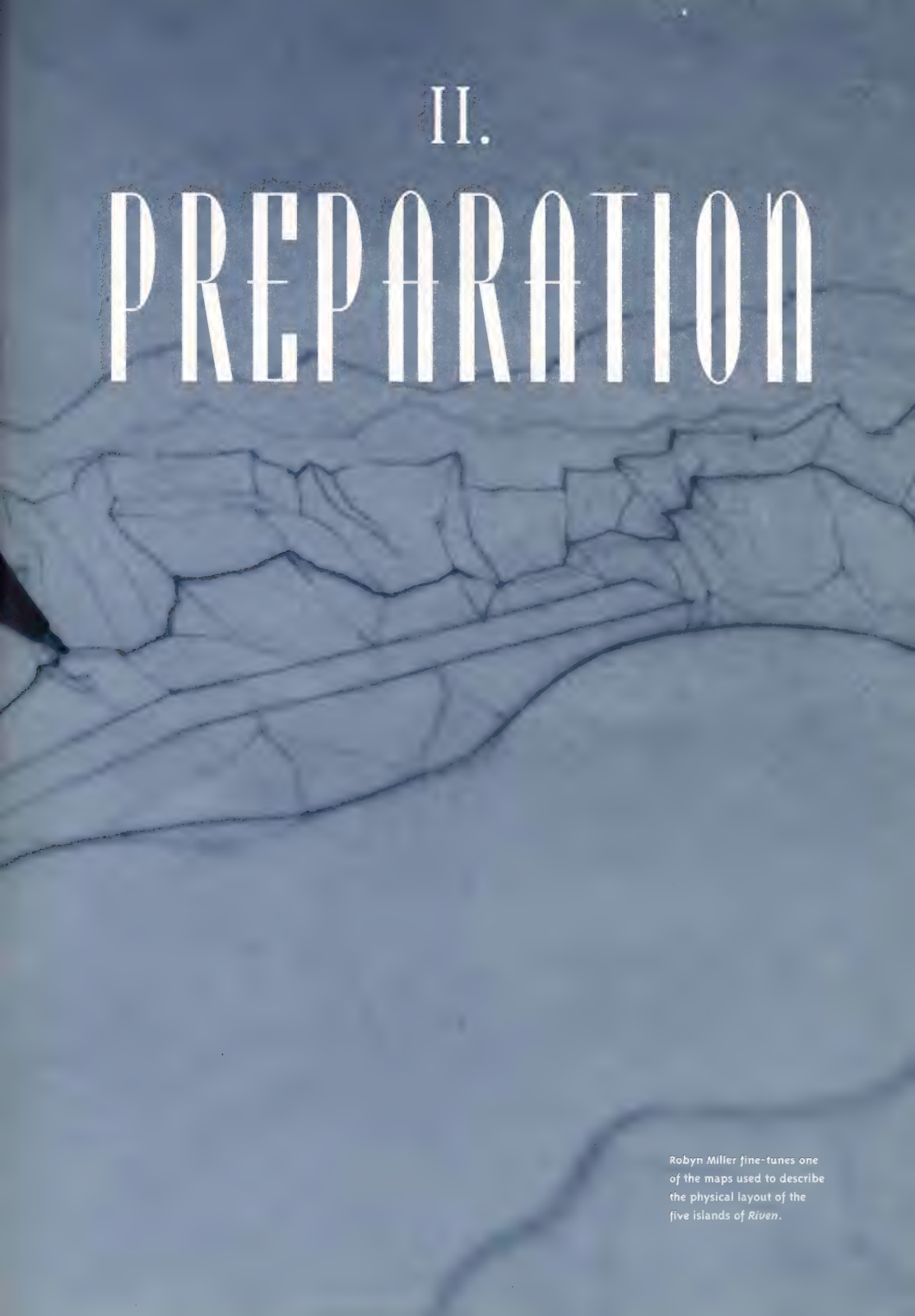
They couldn't have been more wrong.

Richard Watson

Joshua Alton Staub

II.

PREPARATION



Robyn Miller fine-tunes one of the maps used to describe the physical layout of the five islands of *Riven*.

2 artists, 4 macs, and 2 years, ha!

One of the reasons Richard Vander Wende was invited to join *Riven*'s development team was that he, Robyn, and Rand got along well. This was important, since the Miller's knew that building *Riven* would be a multiyear project and that everyone would have to work, if not practically live, closely together. Officially, Robyn and Richard were both directors, in the Hollywood sense of the word. They would make most of the aesthetic decisions that would shape the overall look and feel of the game. Rand remained the producer, which meant wearing every hat he could fit on his head to ensure the production remained "doable." He also worked closely with production manager Tony Fryman, who did the hands-on project scheduling and management.

The lofty titles, however, don't give a true impression of their working methods and conditions. When *Myst* was created, it had been pieced together by the original members working in their separate homes and linked by what Chris Brandkamp was fond of calling "car-net." Basically, if someone wanted to show an image to another member of the team, he got in his car and drove over with a computer disk. *Riven*'s big workspace upgrade occurred in early 1994 and involved everyone moving into Chris's refurbished, though still unheated, garage. This got all the project's developers in one place, including Richard Vander Wende, who relocated to Spokane in September. By this time, Chris's garage was stuffed to the point where it looked like a science fiction sweat shop.

Many at Cyan, Inc., fondly recall the days spent crammed into Chris Brandkamp's garage (above) where *Riven* was started. Eventually, as plans for the game escalated and members of the company grew beyond the capacity of their tiny office, Cyan turned in their thinking caps for some hardhats—momentarily—and broke ground (below) for a new company world headquarters.

Originally, the *Myst* team thought it could produce *Riven* pretty much the same way as before—with a few artists and a bunch of Macintosh computers. But it was apparent rather quickly that their plans outstripped both their gear and their workspace. Robyn and Josh tossed their Macintoshes aside for $40,000 Silicon Graphics Indigo workstations, and a third one was added when Richard arrived. After researching their software options, Robyn and Josh chose to abandon Strata Studio Pro, the program used to create *Myst*'s graphics, and go with the more expensive SoftImage, the

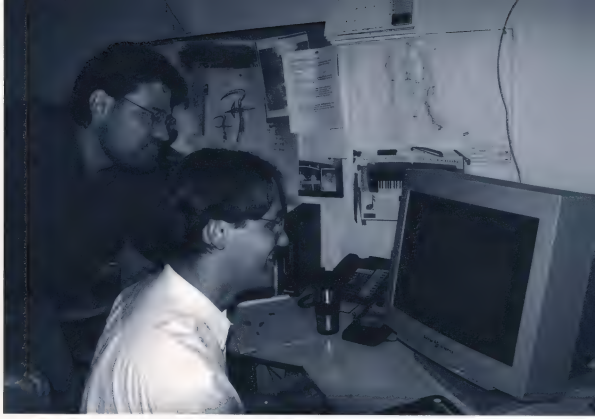
modeling system made famous for creating the dinosaurs in *Jurassic Park*. Finally, everyone realized that if they were all going to make it to the end, then either Chris's garage would have to undergo an enormous remodeling job or a new workplace would have to be found. Taking the plunge, Cyan broke ground in June, 1995 for its own world headquarters just outside of Spokane, in nearby Mead. For the meanwhile, the whole team temporarily relocated to a vacant Comfort World mattress outlet at a local strip mall. Then, slowly but surely, Cyan proceeded to put together the most talented team of artists and programmers it could find. Says Rand and Robyn, "We were well aware that all of our great ambitions for *Riven* were worthless if we could not assemble a team of likeminded people to help us create it. For us, the members of our team were vitally important." While they might have tried to hire an army to build *Riven*, the Millers were intent on maintaining a small, cohesive team in order to keep control over the game's development and produce what they envisioned.

A year later, when Cyan finally moved into its brand new custom workspace, one that bore the distinctive stylings of Myst island, both in design and materials (the D'ni would have felt right at home), that original, and demented, two year deadline had long ago been abandoned. Most of the team had now been working on the project for two years already, and given the ever expanding scope of their ideas for *Riven*, they would simply work for as long as it took.

Try four years.

Tony Fryman

Construction for Cyan's new office began in June, 1995 and was not completed until the following year. The design of the building included some Mystlike touches, including the stone and brick arch (bottom, far left in photo), marking the entrance, and the artists' lounge in the building's lower level (inset) over which hangs a field of twinkling stars.



Rand and Robyn Miller at work in Cyan's headquarters in Mead, WA.

The plan

Between the first three SGI Indigos and the SoftImage software, Cyan had invested around a quarter of a million dollars, giving them more computing power than five *Myst*s would have required. But everything about *Riven* was meant to be bigger than *Myst*—bigger, it turns out, than anyone on the team could have imagined.

The Temple Walk (opposite) on Temple Island sets the mood for *Riven*'s imposing landscape of natural and man-made objects. The fire marble dome in the distance is one of Gehn's key icons, as is his crest (right) which is found all throughout Riven.

From the beginning of the project, the design team planned to accommodate to an even greater extent the two types of players who had been attracted to *Myst*: gamers and tourists. With gamers, it's fairly simple—they want puzzles to solve, the intensity of their addiction being a direct function of the difficulty of the puzzle. For these junkies, Cyan has provided not only more puzzles than in *Myst*, but harder ones as well. The real difference, however, is that in *Riven* the puzzles are more fully integrated into the story and setting, a reflection of who made it and what it's function might be. A puzzle encountered in one of Gehn's rooms, for example, would involve a complex machine, whereas something found in the jungle village would have a simpler, more organic design.

And the puzzles never scream, "Solve me, I'm a puzzle!" Like clues dropped into a mystery novel, they are woven delicately into the overall fabric of the game. The Gate Room in Gehn's Temple is a signature Cyan puzzle. It's filled with enough eyeball-popping visuals to make you forget that you're being subtly presented with a host of clues

Some Favorite Myst Comments:

1. After downloading the puzzle solutions from the net, I easily solved the game in 4 hours. Could you make the next one harder? —Al from Maryland. **2.** Where do Atrus/Sirrus/Achenar eat/sleep/go to the bathroom? —Heather from Kentucky. **3.** At this writing, it has been 2 years and 2 months since the group of us at the Rockmore Retirement Home started playing *Myst*. Is there more than just one island? —Belinda from Tennessee. **4.** I'm left-handed. Is there a way to get a left-handed "grabbie" hand? **5.** I feel kind of sad that Sirrus and Achenar got stuck in those books. Is there a way to, like, rescue them or something? Tell me they really didn't get stuck in those books. —Eric from Georgia. **6.** You don't really know me, but I want to work for Cyan. I'll lick stamps if that's what it takes. —Karl from Missouri. (Cyan hired him.)

concerning both the room, and how to pass through it, and the character and nature of Gehn, who created it.

As for tourists, they prefer to wander around, taking in the fantastic scenery, perhaps mustering up the wherewithal to solve a puzzle or two. In *Myst*, the point is reached fairly early where, if the player is going to move on to solving the game's real mystery, he has to figure out the tower rotation puzzle and gather the clues that provide access to the four Age books. Many were stopped in confusion right there, despite the fact that just before releasing the game the whole forechamber scene on the dock and the note lying on the ground were added to help lead the player to the tower. The islands in *Riven* provide a far more expansive landscape through which to wander, where the player encounters all kinds of rides—a submarine, logcar, and magnetic levitation vehicle—as well as plenty of elevators, doors, and strange devices.

The golden scarabs (right) resting on each of the columns in the Gate Room on Temple Island spread their wings to reveal peepholes through which a series of religious icons are seen (all five of which appear below). The icons are clues to *Riven*'s story—if you can interpret them. The scarab reliefs are inspired by real beetles that live in the jungle and which are an important clue both to the symbolism of the Gate Room and to understanding Gehn, who designed it.

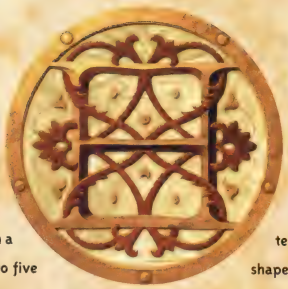
The Story of Gehn

Nothing is insignificant in *Riven*, including the fact that the five massive temple columns are actually tree trunks.

You'll find ancient D'ni script throughout the game. Not mere decoration, Cyan incorporated the rigorous D'ni alphabet, grammar, and number system into the game. This inscription was reproduced with Cyan's own custom D'ni font.

Gehn's crest (right) is found on the floor and door in the Gate Room. Composed of leaves, pen nibs, and book symbols, the number five plays an important role and is a significant clue.

The Power of Five



Gehn's personal obsession with the number five is far from arbitrary and is a major key to understanding him and his passion for everything D'ni. Five is significant throughout D'ni culture. For instance, their number system is based on a five factor and their days are divided into five equal segments. The importance of the number for Gehn is illustrated by his inclusion of it in his personal crest—a five-pointed star—which he adapted from the symbol for the D'ni Writer's Guild. The five arms of the star are actually pen nibs which point to five books, another reminder of Gehn's obsession with D'ni book writing.

Riven also happens to be the fifth Age Gehn has written. The Age is divided into five islands. There are five fire marble domes, one on each island. The buildings and rooms designed by Gehn—including his lab, the office, and the temple gate room—are all pentagon shaped. There are five guilds in Riven. Gehn's obsession even extends to small, seemingly insignificant objects. There are five legs on the lamp stand on his desk and five spokes within the big wheel on the boiler on Book Assembly Island. If you examine the Rivenese schoolroom closely, you'll find a five-armed, star-shaped fruit in a bowl on a table.

Even the name of the Age, Riven, has five letters.

The D'ni symbol (above) for the number five.

From a visual standpoint alone, however, *Riven* builds on the oddly entrancing surreal styling of *Myst* and then surpasses it in ways that will blow these tourists off their feet. With SoftImage software, Cyan's computer artists were able to construct incredibly complex and refined computer models for all the game's objects—everything from the largest islands and buildings right down to a machine's levers and tiniest bolts. Over these models the artists applied highly detailed and realistic texture maps, which are the skins the artists wrap around the models' wireframe skeletons—like bark over a tree, if you will, or steel over a submarine's frame. If done right, a player entering a scene might pause to wonder if this were actually a photo of a real place or object, not something contrived out of computer program code. "Total believability—that's our goal," says Robert Grace, a CG artist at Cyan. For the people at Cyan, there could be no higher compliment.

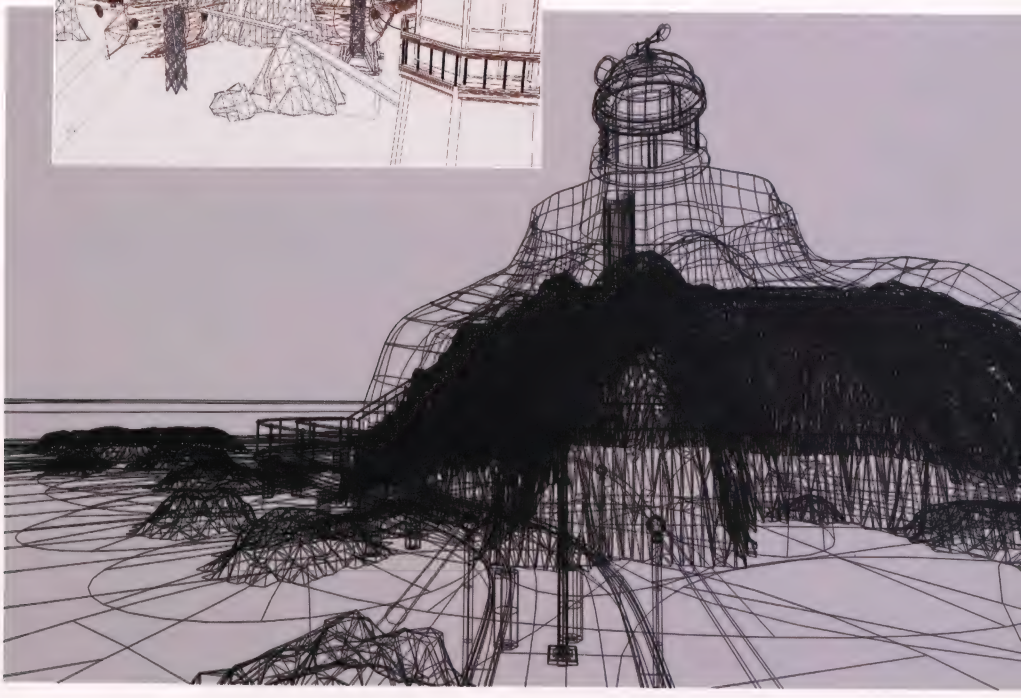
The tower rotation map in the library on Myst Island presented the first significant test of the player's puzzle solving abilities.

But the *Riven* team's ambition didn't stop at designing realistic scenes and objects. They wanted *Riven* to be alive. This meant not only creating fantasy flora and fauna for the game, but animating them as well. This added new challenges. It's one thing to animate the door to a wooden hut or a steel submarine, but how did one bring to life the wahrk, *Riven*'s enormous whalelike ocean predator?

And then there was the live-action footage to be integrated into the game. While *Myst* had small, nicely contained snippets of video footage showing Atrus and his sons, *Riven* called for a whole cast of actors to be shot on a soundstage using bluescreen technology and then digitally composited into the scenes, moving seamlessly in and around computer-generated sets and props. Every scene, object, character, costume, and sound had to work together, technologically and culturally. Complicating this was the fact that there are three main cultures featured in *Riven*: the D'ni, the jungle villagers, and the rebel Moiety, each of which are distinguished by elaborate themes and motifs.

In the end, while *Myst* required only one CD-ROM to hold it, *Riven* would fill five. It contains five times as much computer and live-action animation as its predecessor and is constructed of approximately 4,000 individual shots, compared to the 2,500 in *Myst*.

Robert Grace



The degree to which *Riven*'s complex design surpassed *Myst*'s is clearly illustrated in a comparison of models from each game. The wireframe model for Stoneship Age from *Myst* (left) is not nearly as intricate as that of the Prison Island in *Riven* (below), which is so thick with detail in certain parts that you cannot even see through them.

"We are not ordinary men, Atrus, we are gods!"

—Gehn to Atrus

The story

After their Seattle trip, Rand and Robyn had many of the basic story and game elements that would become *Riven*, although details and names would continue to change right up to the very end. They first called the game Equiquay (the idea being that Riven had become a common linking port). Ultimately, they settled on Riven, the name for the island in Gehn's fifth Age book, where Atrus previously conspired with Catherine to entrap his father, whose delusions of grandeur had made him ultimately dangerous to everyone. Catherine, unfortunately, has been tricked into returning to Riven by her sons, who were also seduced by the power of Age books. And she is now Gehn's prisoner. Riven's world is a collection of islands. Unlike Myst's world, Riven is inhabited, both by forest-dwelling villagers and a rebel faction opposed to Gehn's heavy-handed rule. Even some of the most important goals of the game were clear from the start: the player had to entrap Gehn by enticing him with a false Linking book, rescue Catherine and jump into the fissure of stars at the end. The added twist was that the Linking book is stolen from the player at the very beginning of the game and it's up to him to figure out how to get it back before he encounters Gehn.

There were, however, major differences and possibilities discussed during the game's early design phase. In Rand's original notes, he wrote that Catherine was being held prisoner in another completely separate Age, but then the idea of other Ages was dropped because Gehn was supposed to be trapped on Riven without any books to write in or link through. So the story was confined to Riven's five islands. Both Gehn and the Rebels worked from underground hideouts, and instead of finding a Linking book to Gehn's transdimensional pied-à-terre, players would have to find the secret entrance to his lair. The fact that Gehn was conducting crude experiments in his own bookmaking was a clear part of the story, but at first they wanted to give the impression that Gehn had not yet succeeded in creating an Age book but was on the verge of doing so.

"I need Ages. Dozens of them. Hundreds of them! That is our task, Atrus, don't you see? Our sacred task. To make Ages and populate them. To fill up the nothingness with worlds. Worlds we can own and govern, so that the Ooni will be great again. So that my grandsons will be lords of a million worlds!"

—Gehn to Atrus

Eventually, the possibilities inherent in other Ages led the team to revive the idea and create a separate Age for Gehn, which allowed him to link back and forth to all of Riven's islands and thereby underscore his godlike powers by magically appearing before the villagers. This time, however, the Rebels were also given their own Age, which Catherine had written for them

Among Gehn's more diabolical structures is the Wahrk Gallows (opposite), named for the skulls of the ocean predator that adorn it as well as for its purpose: to punish dissident villagers by lowering them into the water and feeding them to Gehn's hungry pet wahrk.

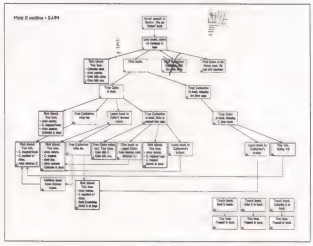
before being confined to Gehn's Prison Island. This is where the player finds her in the game *if* he can reach Gehn's Age and use the Linking book that goes back to the Prison Island. "There was even one design meeting where we considered making Catherine the bad guy," says Robyn. "But we just couldn't do that to poor Atrus. It is an example of how, when designing, everything must at least be seriously considered—if only for a few minutes."

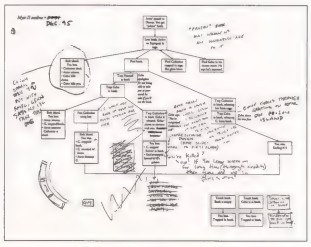
As *Riven*'s gameplay grew longer and more complex, the team needed a way to keep a record of all its paths and possibilities. While an author might write an outline or a film director might use storyboards, the *Riven* team relied primarily on maps of their world. "The maps are essential and a perfect vehicle for creating the broad strokes of world design. By using them you can see the entire basic design for the world in one glance," Robyn says. And with so much of the story dependent on the physical layout of *Riven*, the maps became the best way to track the evolution of the game.

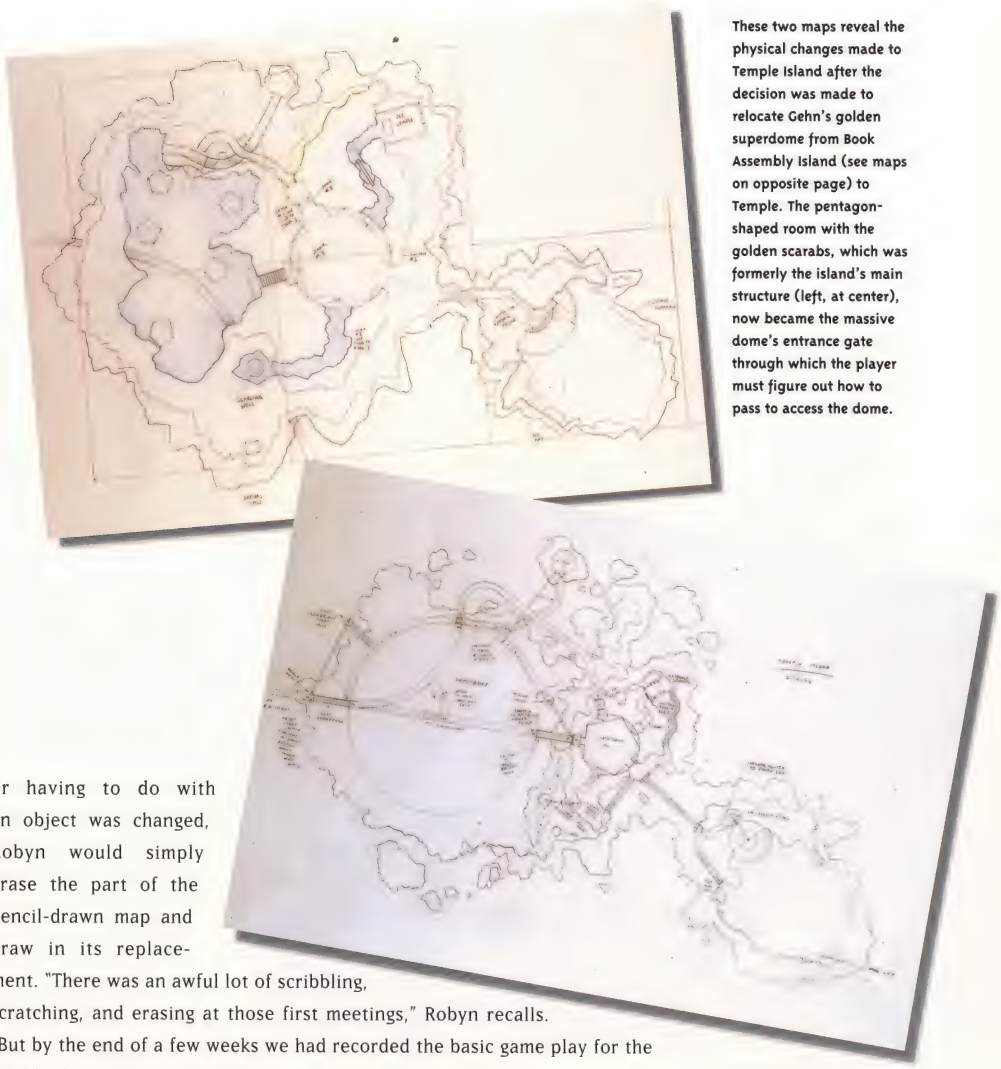
The initial game design meetings involved Rand and Robyn, Josh Staub, and programmer Richard Watson. When an element either of the story line

Typical of the broad sweeping changes that could occur in *Riven*'s layout at any time during its construction, two maps of Book Assembly Island first show the golden superdome dominating its center (top) and then after the island has been completely reconfigured (above), with the dome relocated to another island.

Flow charts (below) tracking *Riven*'s gameplay were crucial tools for keeping track of the mindboggling array of possibilities and were subject to constant revision and improvement.







These two maps reveal the physical changes made to Temple Island after the decision was made to relocate Gehn's golden superdome from Book Assembly Island (see maps on opposite page) to Temple. The pentagon-shaped room with the golden scarabs, which was formerly the island's main structure (left, at center), now became the massive dome's entrance gate through which the player must figure out how to pass to access the dome.

or having to do with an object was changed, Robyn would simply erase the part of the pencil-drawn map and draw in its replacement. "There was an awful lot of scribbling, scratching, and erasing at those first meetings," Robyn recalls. "But by the end of a few weeks we had recorded the basic game play for the world—though it wasn't too pretty."

Later, when Richard Vander Wende joined the *Riven* team, he and Robyn continued working with the maps to evolve *Riven*'s world. This resulted in a smooth and logical gameplay, but it also doomed them to redrawing their tattered maps on a regular basis, "Which was always a pain," Roby says, but a necessary one to accommodate their ambitious world building—and rebuilding—efforts. "In one massive session," Robyn explains, "we moved the gold super fire marble dome from the Book Assembly Island to the Temple Island and moved Gehn's map room from an underground cavern on the Temple Island to the lake on the Survey Island."

In addition to the maps, which helped the creative team keep track of the

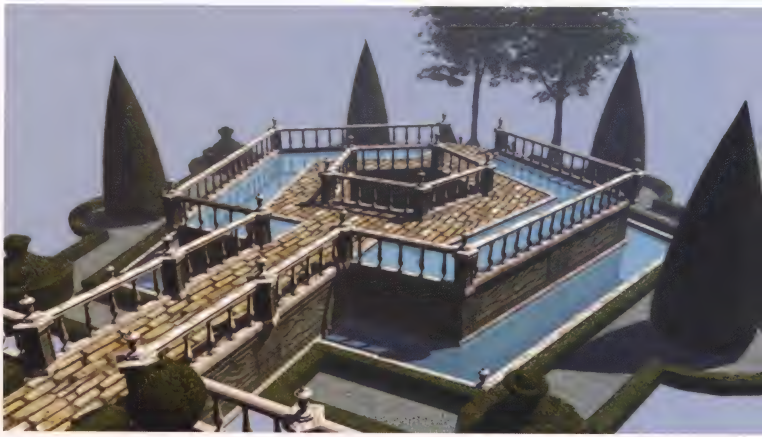
physical layout of *Riven*, large reams of gameplay flow charts were produced that clarified the specific actions and outcomes the player might follow and how they all connected and led eventually to the game's conclusion. The number of possibilities was staggering, but it was the process of continually reviewing and revising the step-by-step gameplay, in addition to the maps, that resulted in a carefully crafted and well organized game. Complicating this picture was the emphasis placed on understanding the manner in which the player reacted to certain situations, objects, and puzzles. In many cases, concept illustrations for buildings and objects were accompanied by game

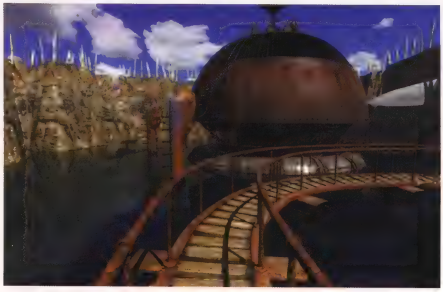
A complete overview (below) of *Riven*'s five islands dated May 1994. Clockwise from top left, the five islands are Book Assembly, Temple, Prison, Jungle, and Garden/ Survey. At this point, the superdome that would dominate Temple has not even been created.

notes that fleshed out these reactions and tested whether or not they felt right or natural.

Once the first maps and flow charts were in place, the *Riven* team took the next step and conducted some simple testing to see how well their game played. In this early, primitive pre-digital experiment, they walked all the members of the company through the maps, explaining what the players would hear and see along the way. Right away, it was obvious that there was one big problem in the game: the Garden Island. Nothing important happened there. It seemed to have no purpose and was "a bit boring," according to Robyn. As with the D'ni, if there was a contradiction or something unstable in what was written into an Age book, it was a matter of rewriting it to make it better.

Garden Island was eventually revamped in complete fashion by Robyn and Richard. The formal English gardens that gave the island its name disappeared and were replaced with a sparse, arid landscape. A lake was added to an elevated plateau, and this is where they placed Gehn's map room. The whole concept for the island took on a more sinister air. Renamed the Survey Island, it became Gehn's control center, from where he could keep an eye on

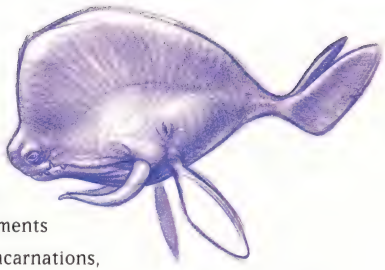




One of the initial constructions for a Garden Island in *Riven* included some formal English style gardens (above) and were reminiscent of his designs for *Myst*. Along with Richard Vander Wende's help, Garden became Survey Island (right) and the sight for some newly designed structures, including the Map Room, that were more appropriate to *Riven*'s evolving style.

The Wahrk Throne Room by itself is an indication of how far *Riven*'s designers have come since the *Myst* days, in terms of its awesome design, emphasis on scale, and purposeful, dramatic lighting—all of which reinforces the sense of power wielded by Gehn as Riven's overlord.

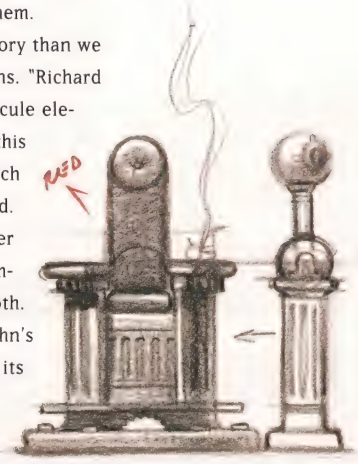
activities all over Riven, including the villagers, Catherine, and the shifting, tectonically unsteady islands themselves.



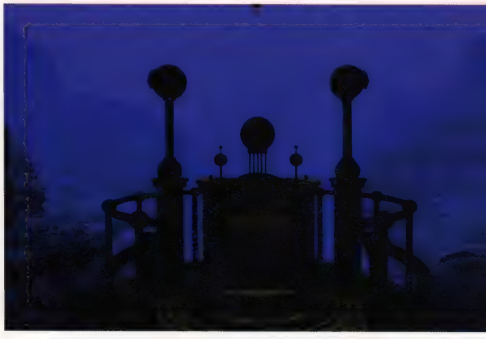
Concept for the wahrk (above), designed by Richard Vander Wende.

In keeping with the physical storytelling style that led them to mapmaking rather than outlining, the team had been working on designs for environments from the earliest stages of the project. In its first incarnations, *Riven* bore a strong resemblance to *Myst*, with neoclassical architecture and graceful gazebos dotting the landscape. Then Richard Vander Wende arrived and proceeded to turn the place on its head. "At first, Richard's suggestions and ideas were a bit unsettling," admits Robyn. Even by the end of 1994, the original team had outlined a good chunk of *Riven* and didn't want to make changes without good reasons. Richard had them.

"He wanted the visuals to tell much more of a story than we knew visuals had the power to tell," Robyn explains. "Richard wanted to see the characters in every single minuscule element that was in the world." Richard demonstrated this idea by first designing the Wahrk Throne Room, which became part of the newly renamed Survey Island. "Originally the room was a closet in which the player would learn D'ni color symbols on some jars of chemicals," says Robyn. But Richard pushed for more depth. He wanted the room to reveal something about Gehn's character, not only in the room's purpose, but in its look and feel.



Instead of a dull closet, Richard came up with a gigantic, oppressive space, where a throne sat atop a pinnacle in front of an enormous window. From here, Gehn could meditate while watching his pet wahrk feed. The room's baroque Victorian fixtures were worthy of a megalomaniacal Captain Nemo. And the room accomplished the same purpose as the closet but in a more interesting manner. A player could learn the necessary color codes by experimenting with the machine Gehn used to feed the wahrk. Using this dynamic storytelling technique, the settings reveal more about the characters that inhabit them—and in a more subtle way—than would have been possible through the game's original design, and certainly more elegantly than if the information were simply stated in words. The real impact, however, was to make the player more involved with *Riven*'s world.

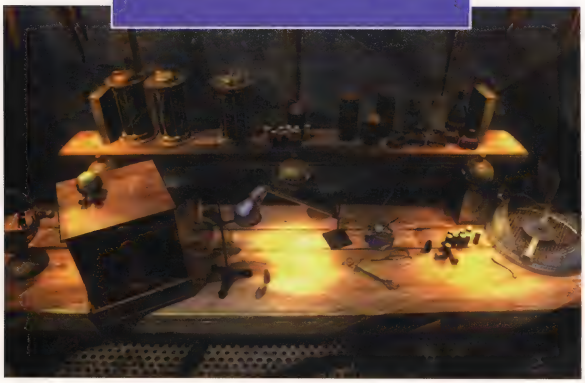


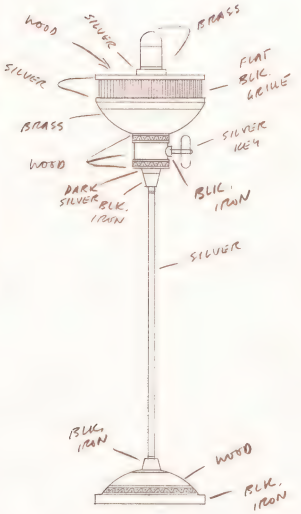
Gehn's throne in concept sketch (top) and in its final form as seen in the game (above).

"After Richard created the Wahrk Room, I suddenly became much more interested in this cinematic and meaning-driven approach to creating an interactive world," Robyn states. The team was impressed enough by the design and approach to immediately incorporate it into *Riven*, and to go through the entire game and redesign it according to these cinematic principles. Now, the villagers are defined by the earthy, organic atmosphere of their environments, structures, and tools, the rebels by their African-inspired idols and weapons, and Gehn by his ornate Victorian mechanical devices.

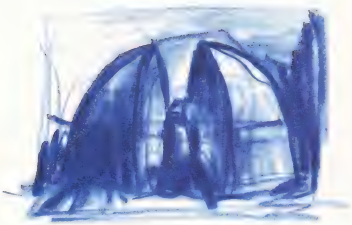
Concept art and final images from the game reveal the organic, natural styling behind the design of the tools, structures, and totems related to the jungle villagers, whose primitive state contrasts sharply with their ruler's obsession with powerful machines and intricate devices.

While Gehn's objects tend to reflect his taste for industrial beauty and a certain opulence—as in the exquisitely designed music player found in his office (below)—there are also several items which incorporate materials from Riven's natural environment and are designed to reflect his attempt to dominate his surroundings, including this wahrk tusk lamp (left), which is used to light a desk in his lab (below left).

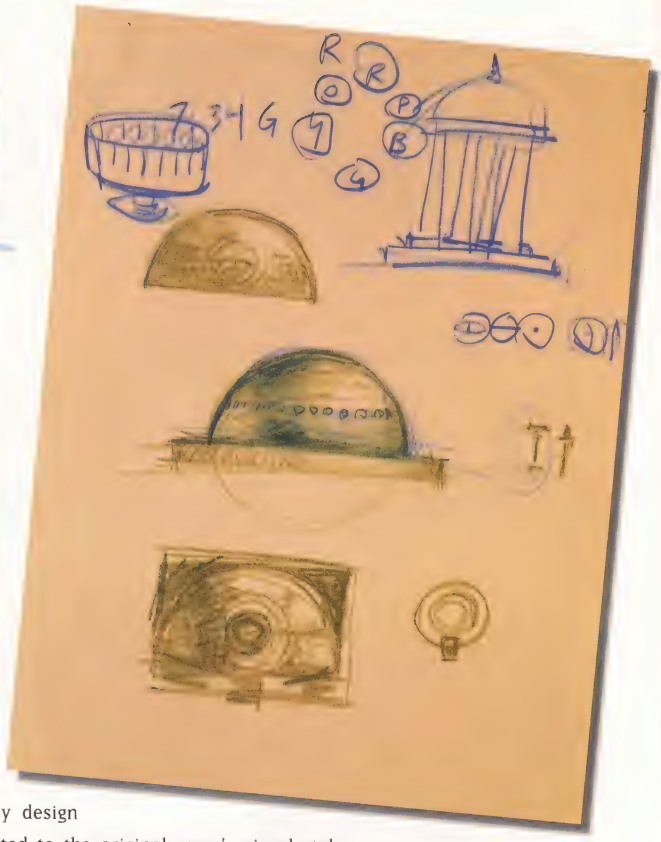




Gehn's architecturally ornate elevator on Survey Island (an early version at left and the finished design above) is a good example of how the artists designed Riven's environs and the objects in them to reflect the characters associated with them.

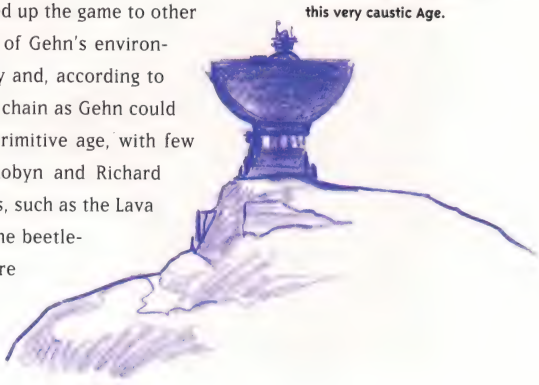


The rusty fire marble domes which dot *Riven*'s landscape evolved out of some early gazebolike structures with columns that were more in the style of *Myst*'s structures.



When the visuals were established as a key tool for revealing character as well as story, the personal tastes of the artists became secondary. For instance, Gehn's signature constructions in *Riven*, his fire marble domes, were originally gazebos. Why? Because there had been similar structures in *Myst* and during the early design phase, Robyn had naturally gravitated to the original game's visual style. Under Richard's questioning, however, it became clear that they didn't fit in with Gehn's psychology. A brutish and showy man, Gehn would want something imposing to show off his strength and feed his ego. While their main purpose was to protect the Linking books that connected Riven to Gehn's Age, their visual relation to their creator's personal tastes—and to the master puzzle behind *Riven*—was another equally significant feature.

The inverted half-dome design for the office in Gehn's Age is clearly related to the fire marble domes in *Riven*, since it is through these domes that Gehn's Age is reached. This unique "open" shape is used to catch rainwater in this very caustic Age.



While the gazebos were lost, this method opened up the game to other interesting visual possibilities. The Victorian look of Gehn's environments fit both the D'ni's aesthetics and technology and, according to Robyn, "seemed about as far up the technical food chain as Gehn could climb considering that he was exiled in a fairly primitive age, with few tools to work with." The Victorian motif gave Robyn and Richard license to design some exquisite objects and scenes, such as the Lava Room on Survey Island, the Mag-Lev vehicle and the beetle-adorned Gate Room on the Temple Island. This desire to make an area or object reflect personality was also the key to creating the map room on Survey Island when it became clear that the

To open the dome itself, the player must press the button on top of the rotoscope at the exact same time the correct image is seen through its eyepiece (left and below). Accessing the Linking book to Gehn's Age within (bottom) requires entering a combination to release the external lock.

island's formal gardens didn't contribute to the game.

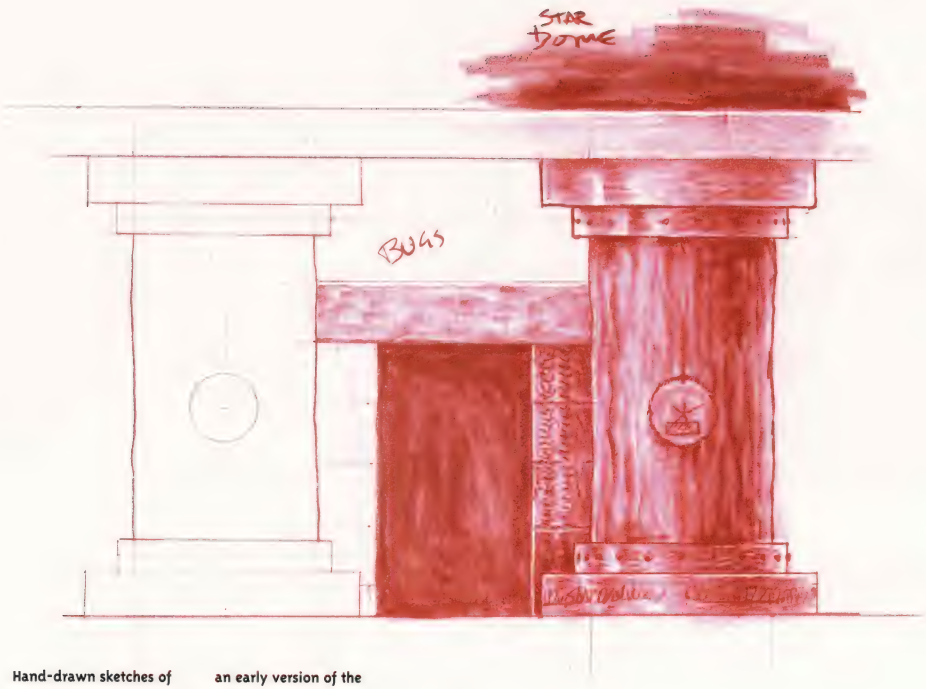
What Richard's method did, finally, was solidify a process that had been at work within the team since the beginning. *Riven* was never a game that could be written down and locked into place in one shot or even two. It needed room to breathe, grow, and expand as the story and gameplay gradually developed. Richard's character-driven design method gave the *Riven* team the approach they needed to continually shape their imaginary world, adding depth and excitement to the game.

Richard explains it simply: "To construct a believable world, you have to evolve it."

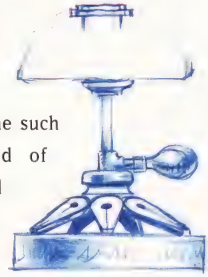
III.

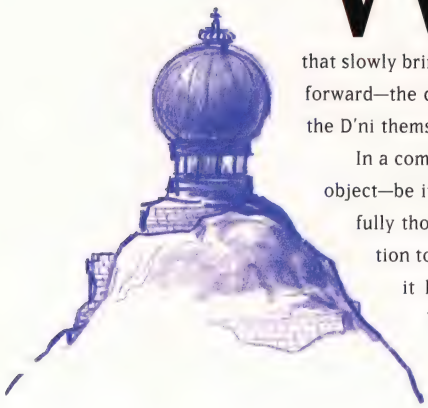
CONSTRUCTION

Wireframe model of the submarine on Jungle Island.



Hand-drawn sketches of the entrance to Gate Room on Temple Island (above), a lamp incorporating the five pen nibs from Gehn's crest design (right), and an early version of the office in Gehn's Age showing a complete globe before it was cut in half (below).

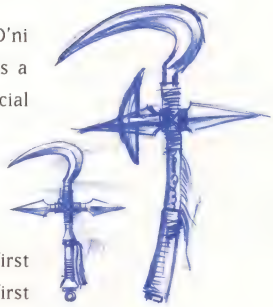




Concepts

When creating a complex game such as *Riven*—a fantasy world of buildings, machines, and objects all interrelated by the puzzles and solutions that slowly bring the story into focus and carry it forward—the design team was faced with a task that would have impressed the D'ni themselves.

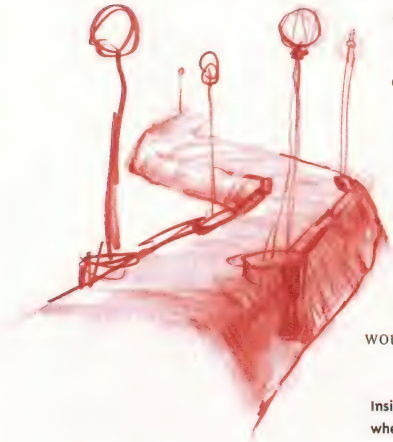
In a computer-generated universe, nothing is taken for granted. Every object—be it an island, a stone building, a leaf, or a rivet—must be carefully thought out and articulated, not only independently but in relation to everything else. If there was a bowl of fruit on a table, would it hold apples, oranges, or some exotic fruit? If there was a Victorian-style lamp, would it's base be brass or iron? Would the pens on Gehn's desk resemble anything we've ever seen before or be completely imaginary?



Drawings of the rebel-made scythe-like weapon (right) and of a walk with lamps found on Jungle Island (below).

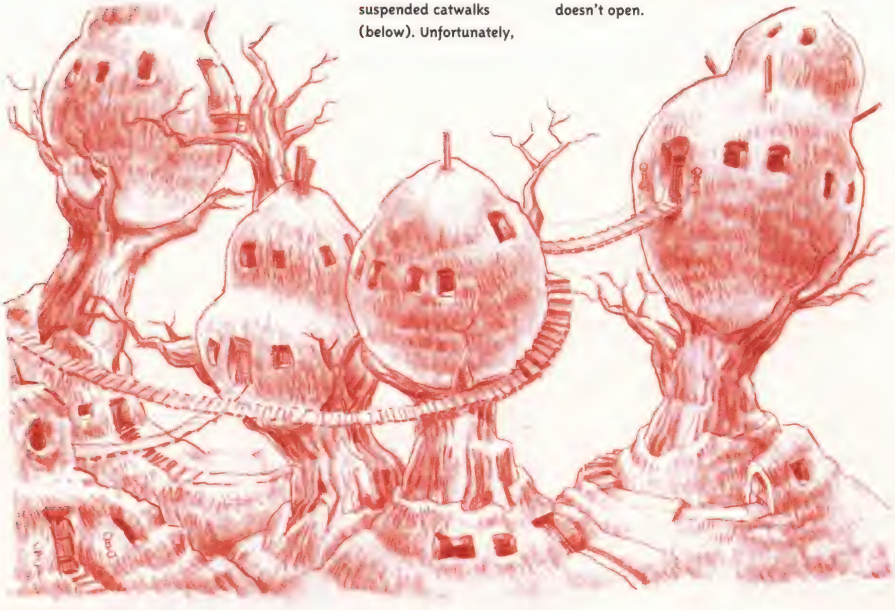
In *Myst: The Book of Atrus*, Gehn describes D'ni bookmaking to his son Atrus as follows, "It takes a great deal of work to create an Age. There are special formulas you have to follow, precise laws to obey. . . . it is not simply an Art, it is a science—the science of precise description.

"When we begin, there is nothing," Gehn goes on to say. "It is . . . *uncreated*. But as soon as the first word is written—just as soon as that first character is completed, the last stroke set down upon the page—then a link is set up to that newly created world, a bridge established."

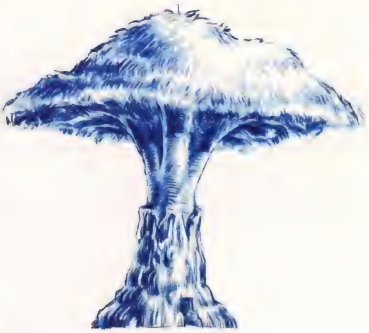


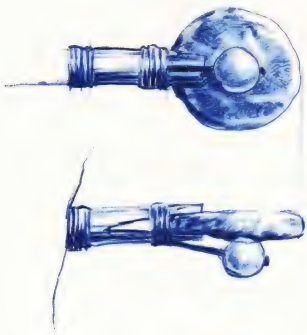
The *Riven* team, like the D'ni, began with a blank page but immediately began filling it with concept designs for all kinds of stuff. "Robyn and I produced sketches for nearly every object in the game," says Richard, "although most of the time they were quite rough. We'd usually only develop an idea on paper until we felt we had enough information to communicate that idea to the person who would be building the computer model."

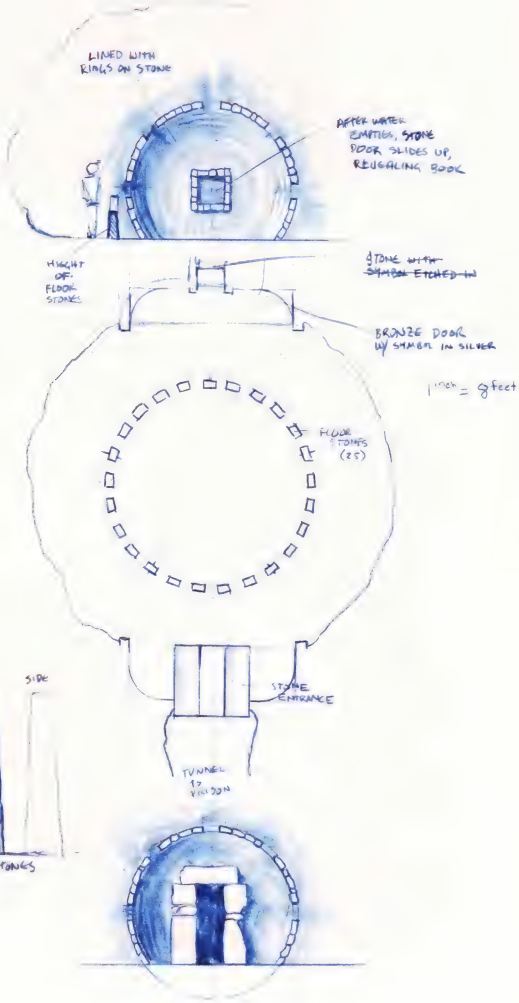
Inside the huge pod where the rebels hideout in Rebel Age is the village of miniature pods used as huts and connected by suspended catwalks (below). Unfortunately, this is one of the few times the player is not able to explore further as it is only visible through a panel on a door which doesn't open.

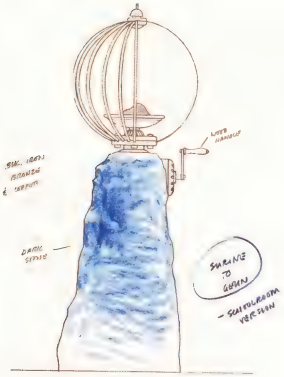


The concept art on these pages reveal how every single aspect of *Riven*'s imaginary world was worked out in sketch form before modeling began, including all the natural flora, machines, and devices ranging from lamps and magical imagers to valves and boilers, and the details of entrances and passageways.

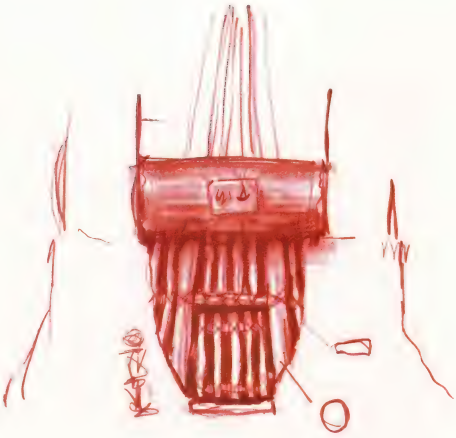


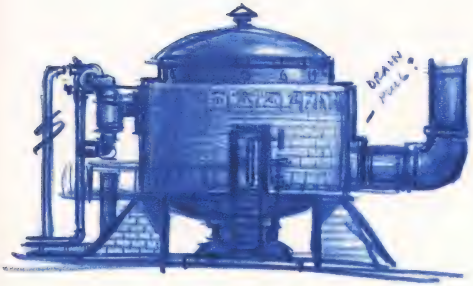


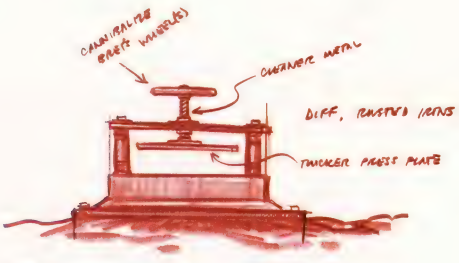


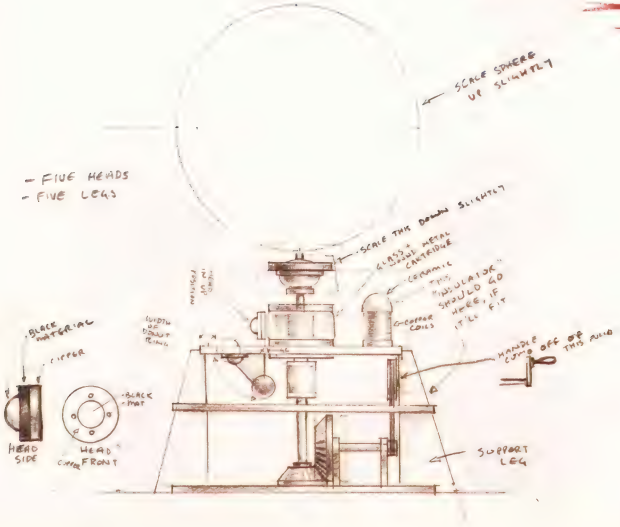


In several locations about *Riven*, Gehn's small hand-cranked imager (above) will be noticed. Depending on the imager, a different "home movie" is seen: in his bedroom Gehn can play a scene of his wife; in the schoolroom it delivers a greeting from Gehn to the children; in the Temple Room, however, this very large imager actually projects live images of Gehn from his office.

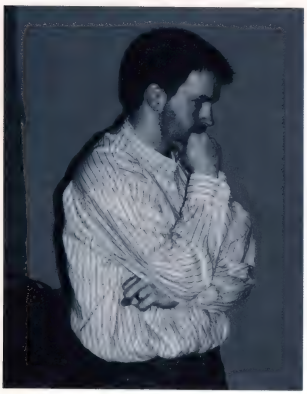




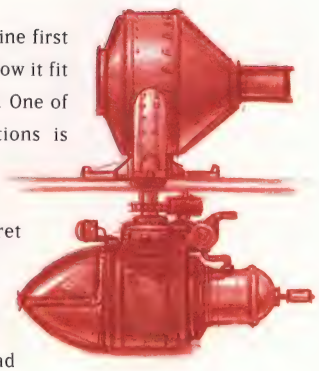




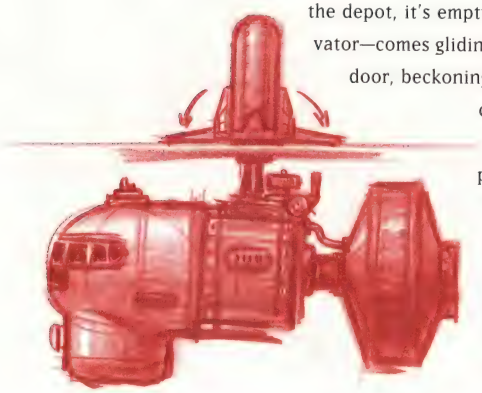
Many of the concepts for machines or devices, such as the book drying press (above) and the imager in the Temple Room (left)—were accompanied by handwritten notes that detailed the specifications for the design, the function of certain objects and parts, as well as the type of styling and look the artists wanted to achieve, including comments on how shiny or rusty the metal should appear or how worn or aged a piece of wood might be.



Bret St. Clair

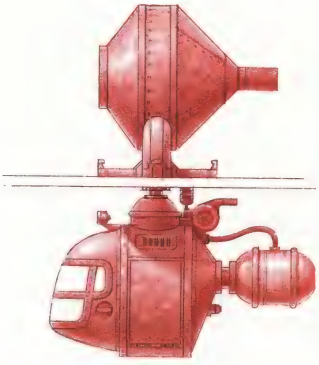


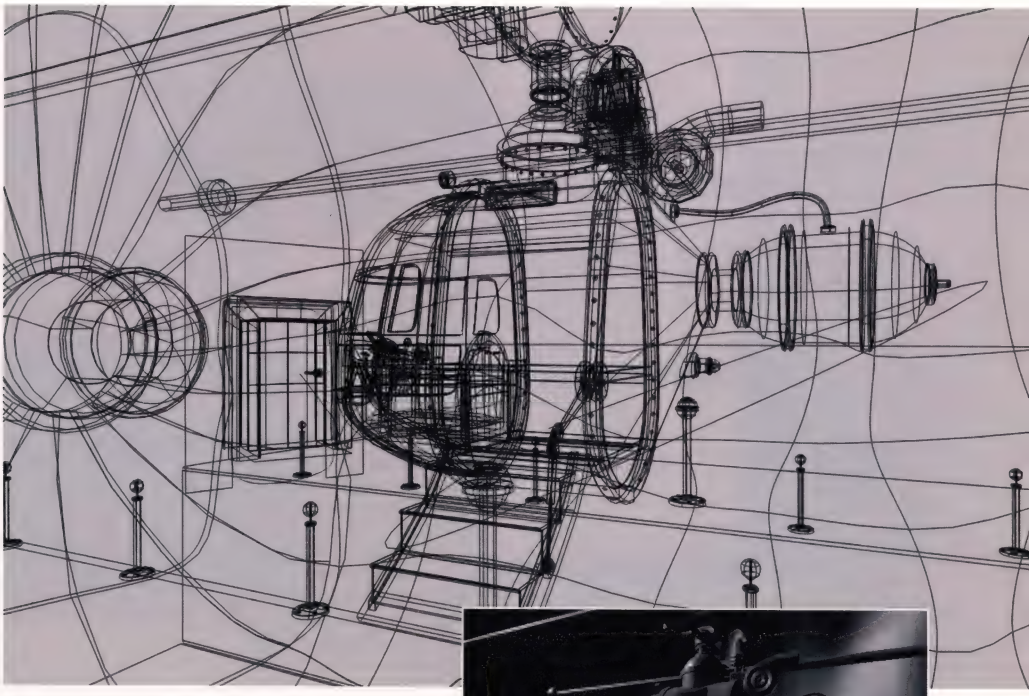
The most important issues to determine first involved what the object would be and how it fit into both the game and the Riven world. One of *Riven*'s most interesting creations is Gehn's magnetic levitation car, which was designed by Richard and built by computer artist Bret St. Clair. Not only was the Mag-Lev a tasty piece of eye-candy, it was a good example of how thoroughly the designers had imagined *Riven* and the characters who populated it. A transportation system built by Gehn would naturally have to reflect what the Cyan team knew about D'ni science. As Richard explains, "the D'ni favored raw forms of energy, such as magnetism. It was a quick, clean propulsion system and fit in both with their technology and the D'ni's refined aesthetic sense." For Richard, the Mag-Lev car was also an interesting design opportunity. Richard continues, "when the player enters the depot, it's empty. He pushes a button and this *thing*—this deluxe elevator—comes gliding in. It rolls around, settles itself and swings open the door, beckoning the player to enter. This is essentially the mechanical version of the Wahrk. I wanted it to feel alive."



The Mag-Lev car was also typical of the multistep process the team used to complete each final image. First came the basic design, for which Richard drew inspiration from Victorian-era steam locomotives and pictures of weird, bulbous World War II airplanes to come up with a transport system that would make Jules Verne drool. He made numerous drawings until he was satisfied with the overall

The first step in creating any scene is to try out different designs for the props. In the case of Gehn's magnetic levitation car, lead designer Richard Vander Wende produced a number of rough sketches (top right and above), then refined the car's design (right) before handing things over to computer graphics artists.





concept. Then he handed his sketches and a set of detailed specs over to Bret St. Clair. For the artist, the image's specs were every bit as important as the illustration itself. In this case, they told Bret not only the dimensions of the craft, but how the objects moved, which parts were animated, and what materials each section was made of.

Using SoftImage, Bret began by constructing a wireframe model in the computer. The frame functioned as a skeleton upon which Bret could then build the final image. Once the model was basically complete, Bret added shaded surfaces to the frame's contours so that it looked like a ghost of the final image. At this stage, the overall shape of the car was reviewed for its basic integrity and faithfulness to the design. After consulting with Richard, Bret applied actual textures, called color maps, to the surfaces of the model, drawing on Cyan's vast library of custom textures made from photos of all kinds of surfaces—metal, stone, fabric, wood. These photos had been scanned and modified using Adobe Photoshop to create texture maps which the artists could stretch onto any object in a scene.

Once Bret applied the metal and rust patterns to the surface of the car and added animation of the side door sliding open and shut, he placed the image into it's proper scene. To create the setting for this indoor docking station,

Using SoftImage software, computer artist Bret St. Clair constructed a wireframe model of the complete scene, including the car (top) which could then be previewed as shaded polygons (above) in order to review the overall design for any changes the designers might want to make before taking the next steps.

Textures for all the surfaces are chosen from Cyan's library of custom textures. Each texture is then applied to its designated surface. In this case, the metal (below left) and rust is applied to the car and the rock (below right) to the cave walls. After making final touch-ups on the textures the scene is previewed again using simple ambient lighting (right).

Bret, along with Tony Davidson, went through the same process when building the car: receiving a basic design, creating a wireframe model of the entire layout, and covering it with surface textures. With all the elements of the scene combined, the design team previewed the scene with simple, ambient lighting. Once they were satisfied with the "camera angle," or the point-of-view from which the player would see the shot, the next step was to add lighting to create the right atmosphere. *Riven*'s images were as elaborate as movie sets and required just as much effort to light for proper effect.

None of these steps happened quickly. The finished image of the car took about three weeks to create, with the dock and the Mag-Lev tracks requiring another month. Since the design team knew that the computer modeling would often take weeks to complete, they frequently skipped the early pencil sketches of their images and started creating digital versions as soon as they had a basic idea of the design. They knew from creating *Myst* that no matter how carefully an object was planned, once it became a 3-D computer graphic, issues and problems would appear in its construction, or changes to the story might affect its role or function. In fact, Gehn's Mag-Lev system itself was first conceived as a more interesting and exciting substitute for a series of bridges built by Gehn that, in the game's early stages, connected all the islands to one another. It was quickly obvious, however, that it took an extremely long time to get around this way (they were really long bridges) and it would be pretty dull going for the player (click, click, click, click) every time he wanted to move from island to island. Later still, once it was decided Gehn could bounce around Riven's islands via his Linking books, the Mag-Lev ride was limited to serving only three out of the five islands, while all that's left of the bridges is the one connecting Temple Island to Book Assembly Island.

Tony Davidson

The last step is to light the scene for the right atmosphere. It's common for each of *Riven*'s images to have as many as 40 ray traced light sources; this particular one has 42. A SGI Challenge L server cooked for about four hours to render the final high-resolution image (left).

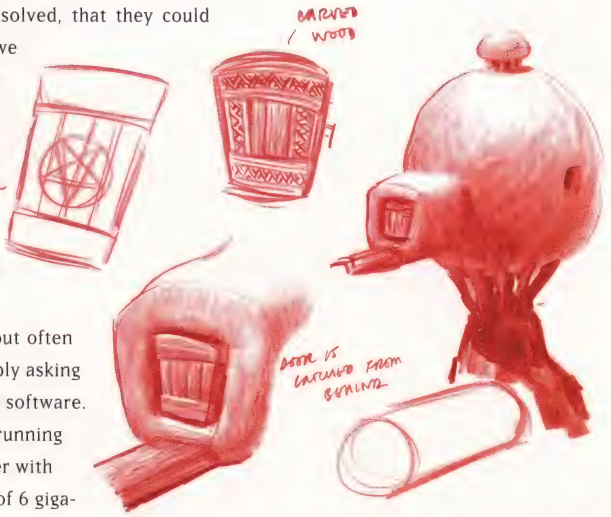
Models

Models, such as that of the Rivenese village on Jungle Island (above) are 3-D wireframes over which textures, shaders, and lighting are added to create the final, super realistic images seen in the game (below).

Just as massive building projects in the real world go through redesigns, equipment failures, delays, and cost-overruns, so too did *Riven*'s construction. You just don't build a world without cracking a few mountains.

The *Riven* team's ambition pushed its technology to the limit. In their quest to create a fantasy world that was both spectacular and believable, they designed each scene with tremendous complexity and depth. The exterior scenes consisted of all 3-D modeled objects—dozens of them in every shot. These objects were built in much the same way as the Mag-Lev car and the other major images: a polygon at a time. In some of *Riven*'s scenes—especially on the Jungle Island—the thicket of polygons is so dense and tangled that it looks like an explosion in a wire hanger factory.

Josh Staub explains, "Once we got the SGI computers, we thought all our problems were solved, that they could render anything and everything we wanted." The computer artists often discovered, however, that when their images hit a certain level of density (or number of polygons), even Cyan's brawny new SGI Challenge L server could not handle them. Sometimes the problem was the design, but often it was the gear itself. They were simply asking too much of both the hardware and software. Even with the two SGI servers—one running with 2 gigabytes of RAM and the other with 4 gigs of swappable RAM for a total of 6 gigabytes—it was still taking hours upon hours to render some of these extra-dense scenes.



A design sketch for the huts found in the village on Jungle Island, including some variations on the entrance doors, one with Gehn's crest burned into the wood (far left).

In addition, the SoftImage modeling program appeared to have an upper limit for how many polygons it could stitch together in a scene. Hit that limit and PRESTO!—everything comes to a screeching halt. Add to this Cyan's discovery that SoftImage contained some subtle bugs that would crash the system when the software was working on a really big-time image. But all was not lost. Enter Cyan's CG technical director Karl Stiefvater. He was Cyan's star SoftImage debugger, writing patches to get around the software's glitches, and one of their experts on figuring out model design problems.

As Cyan quickly found out, you can never have enough raw computing power. Three SGI servers were set up to run continuously in order to render the thousands of images in *Riven*.

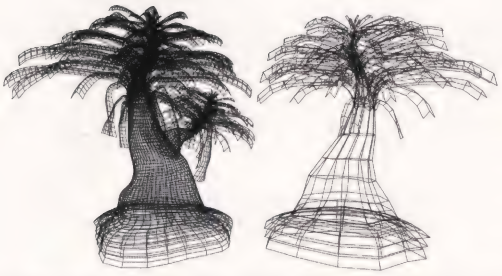
There's an art to computer graphics that isn't always obvious. A truly fine computer artist creates the maximum effect with the fewest polygons. It's a subtle kind of minimalism, one that rewards the artist who can learn to best use thousands of polygons instead of hundreds of thousands of them. Fortunately, many of the scenes that were too complex to render properly could be fixed by simplifying them, i.e., lowering the number of polygons.

The trees on Temple Island, for example, were very complex and detailed models. Since they were designed and completed early, the first tendency of the artist who was assembling a scene on the island might be to drop in one of these complex models, even if the trees were only visible from a great

Robin Foley

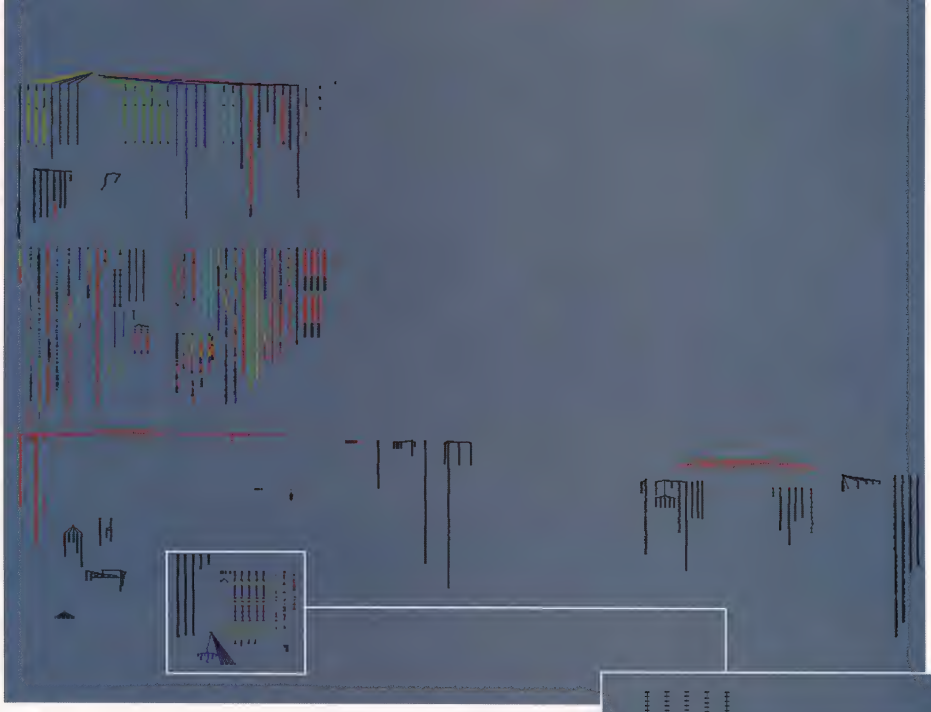
distance. In computer terms, this meant that even though the trees might be a speck on the screen, the SGI still had to render the full and very complex model. For many scenes, this was simply a waste of time and meant that there was just too much information for the system to handle.

For these situations, the design team developed a compromise. They built scaled-down versions of some of the more complicated and frequently used models. It was frustrating aesthetically. In the case of the trees, Robin Foley had modeled a lifelike 3-D version of them, and the artists would have preferred to use that as-close-to-perfect-as-they-could-get version as much as possible. The full version was smooth and lifelike, whereas the simplified model was always faceted—its edges covered with the tiny shark-fin ridges that are a dead giveaway for a computer graphic. But most of these images were small enough that the facets wouldn't be visible to the naked eye, and therefore dropping in a simplified version of the model often meant the difference between a scene that rendered and one that didn't.



Polygons weren't the only thing the *Riven* team had to worry about when it came to rendering. Each scene required properly organized schematic flow charts that verified for the computer system how an object in a scene related to each of its parts and to other objects, which

In order to save time in rendering, several versions of a model with varying complexity were created and used accordingly. The two models of the trees (left top) on Temple Island, for example, illustrate the differences in complexity of the inner structure. Depending upon the scene, Cyan would use the simpler model (on right) when less detail was needed and the more complex one when very fine detail was required. The same two models are shown in shaded and partially colored form (left middle). In certain cases, an image might contain examples of both kinds of models (left). Note the tree in the background (simple model) and the one in the foreground (complex model).

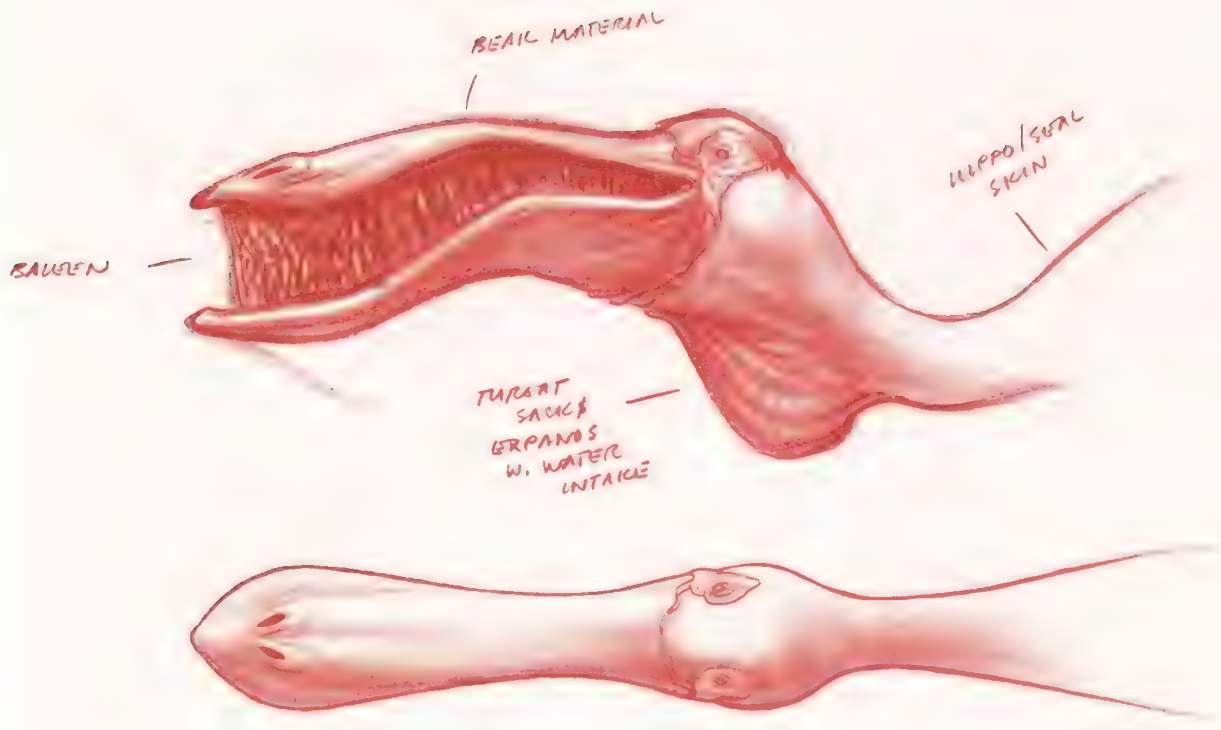


Schematic flow charts created in the software to track the hierarchical relation between every scene, object, and detail, including animations, were the blueprints for analyzing the structural integrity of the image. They were also the bane of the CG artists existence, as the extent of detail and the ongoing changes made to these details often caused massive headaches when they had to doublecheck the charts looking for answers to problems in rendering the images. The flowchart shown here is from Jungle Island and ends on the very last detail of a section of a board secured by a screw (below).

objects had animations attached and what parts of those objects actually moved. These schematics proved to be a headache throughout *Riven*'s design. "You should take a look at some of our schematic flow charts—some of them are crazy," says Richard Vander Wende.

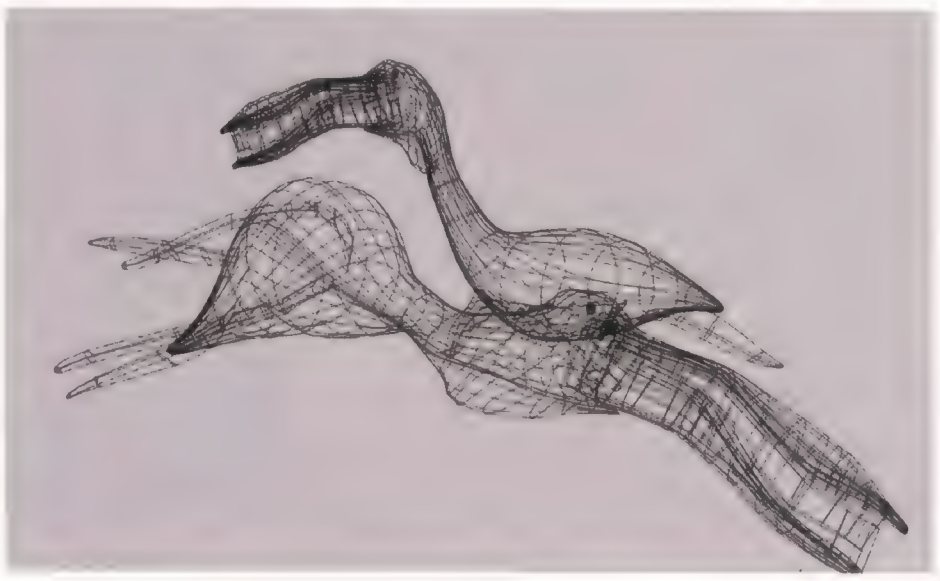
Schematics look like family trees, with related objects grouped together in order by branching lines. While the software automatically built a default schematic as a scene was constructed, it wasn't necessarily correct and it was up to the artist creating the scene to go in and check it. If the hierarchical list wasn't just right, the image wouldn't render. Just as they might have to rework a scene to decrease the number of polygons, sometimes an artist would have to modify a seemingly finished scene to correct the logic of the schematic.

Perhaps the most novel challenge to the *Riven* creators was the modeling and animating of organic forms. In *Myst*, these had been limited to a few



The sunners (left and opposite) are one of *Riven*'s original animal creations. They were inspired by both a pelican and a penguin but owe a lot of their design, by Richard Vander Wende, to a combination of a plesiosaurus's body and the whalebone mouth, used for sifting plankton, of a baleen whale.

butterflies and sea gulls, but in *Riven* there were plans for beetles, frogs, birds, fish, fireflies as well as newly imagined beasts, including wahrks and sunners. The artists, many of whom had relatively little experience with computer animation, were now faced with constructing wireframes for animals that had to move in a lifelike fashion. How could they create these models and not have them look like computer-generated sock puppets? SoftImage provided the technical answer, but not right away.



When the artists began creating the first models for *Riven* back in 1994, their best option was to build them out of polygons, which are point- or coordinate-oriented and have straight edges and flat faces. A model made up of polygons can be made to bend and turn but if its meant to simulate the motions of a real animal, the effect will be a slightly robotic one at best. Eventually, SoftImage released a software update that vastly improved its other option, called a patch. Patches have spline-based surfaces and these can be made to bend, curve, expand, and undulate—in a word, to behave in more responsive and "organic" ways. Richard Vander Wende compares creating a patch object to working with "virtual" clay. It allowed him not only to mold soft, lifelike shapes, but to animate them in natural ways.

By constructing the sunner models with patches instead of polygons (middle), the CG artists provided the proper flexibility in order to create a realistic living-and-breathing creature (in shaded polygon stage above) and to animate it to move in believable ways.

Textures

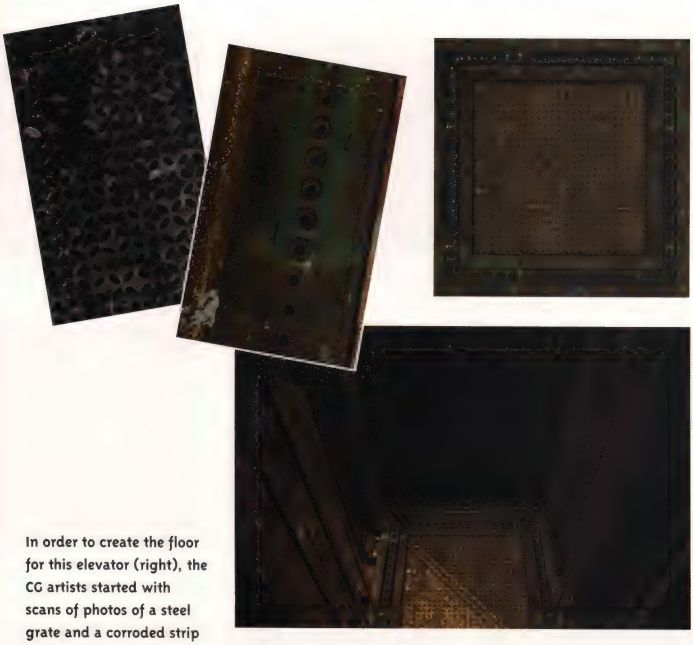
The Japanese have a word—*wabi*—that refers to the deliberate imperfection in any piece of art that marks it as a human creation. The problem with computer graphics is that they don't have *wabi*. So artists have to go in and trick the software into making a perfect creation seem imperfect and more lifelike.

One of the ways to create lifelike computer images is to cover them with realistic textures. It doesn't make sense to draw a 3-D image of a tree pixel by pixel when you can simply model the tree's outline in polygons and wrap it in a texture map. These maps are like computer wallpaper made from, in this case, a photo of real tree bark. While still designing *Riven*, Robyn, Richard, and Josh traveled to Santa Fe and Taos, New Mexico, and shot hundreds of photographs of every surface that caught their eye: aged wood, rusted and corroded metal, natural rock, plaster, and adobe. Back in Mead, every print was scanned into the computer, creating a library of surfaces to choose from. The New Mexico shots became the basis, according to Robyn, "of 95 percent of all the textures you see in *Riven*."

Original photos of all kinds of surfaces, such as the one below of a very rusted mining drum, were shot during a trip to New Mexico and made up a vast library of textures.

On the Trail of Textures in Santa Fe, New Mexico

"The idea behind the trip to Santa Fe was to go to a place where everything had been modified by an environment that we thought was like the environment we were imagining for *Riven*," says Richard Vander Wende. By the time Robyn Miller, Josh Staub, and Richard returned to Spokane, they had shot hundreds of photographs of surfaces. "We came back with so many that it was a little difficult sorting through them," Robyn says. While they spent a lot of time examining the local adobe structures, colorful rock formations, and the dried animal bones that seemed to be everywhere, some chance finds added to the excitement. "We stumbled upon this great scrap metal yard down by the train tracks in Albuquerque—something we hadn't anticipated," Richard says. Virtually all of their metal textures came from this one site, everything from the lumpiest rust to barely tarnished iron.



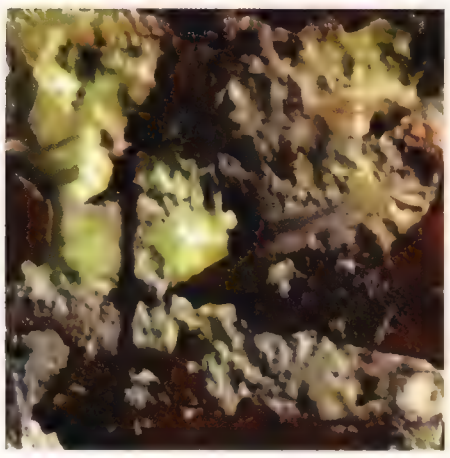
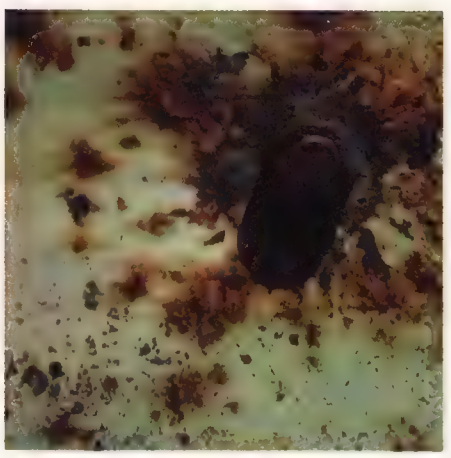
In order to create the floor for this elevator (right), the CG artists started with scans of photos of a steel grate and a corroded strip of metal (above). They spent as much time as necessary retouching the images in the computer to produce a satisfying texture map (top right). This map was then applied to the surface of the elevator model, giving the object its finished look.

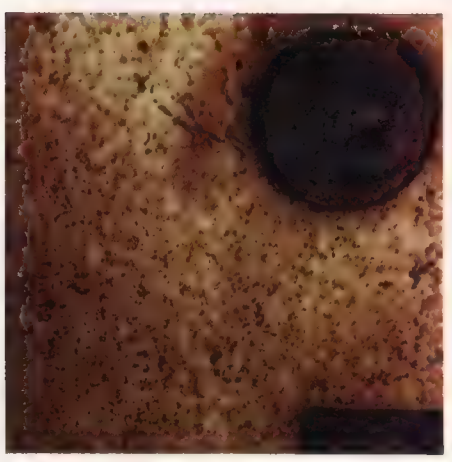
The sequence of images below illustrates the step-by-step process used by the CG artists to apply textures to the modeled objects in the game. In this case (top to bottom), the first step produces a straight scan of Richard Vander Wende's hand, followed by a version manipulated in the computer, and finally the image itself which incorporates the final texture into the bed cover.

Of course, creating a digital tree isn't as simple as "gluing" a scan of some bark to a computer model. Cyan's artists would spend hours customizing all their textures by modifying the scanned images in Photoshop, where they aged, weathered, recolored, and tiled to greater size many of the images, producing textures that achieved a heightened sense of digital reality as opposed to a purely photorealistic one. The unique textures—their colors and tones—are one of the distinguishing features underlying the *Myst* "look" that so captivated its audience.

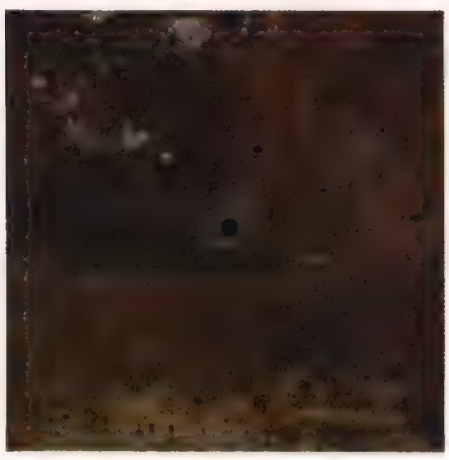
In one case, a texture was derived from a truly innovative source. When confronted with designing a leatherlike cover for the bed in Gehn's room, Richard began by considering the idea that leather on Riven would not be leather as we know it. With that in mind, he proceeded to scan his own hand and retouch the image into the final color and texture you see in the game shot.

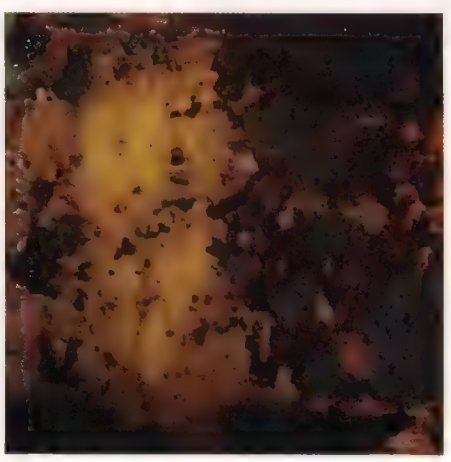
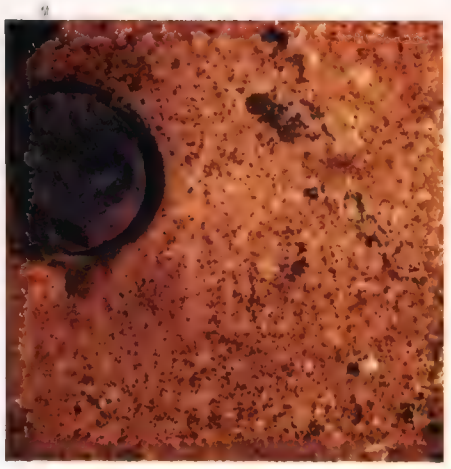
Metal

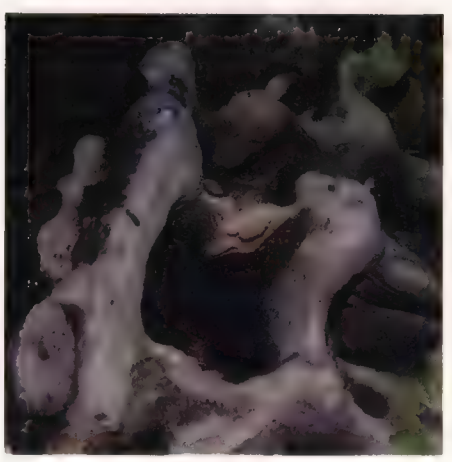


Rust



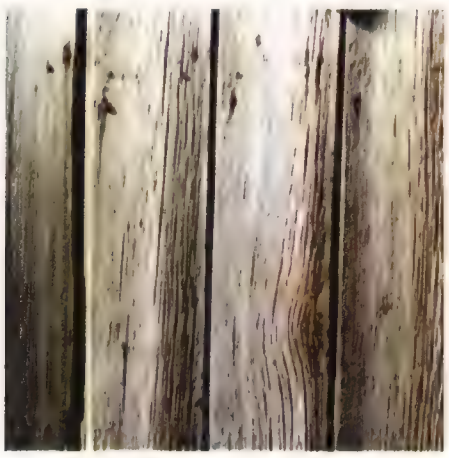



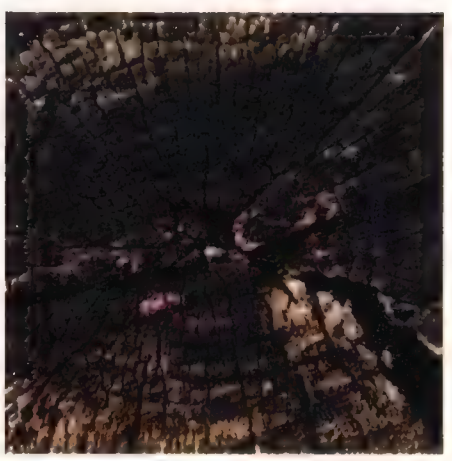
Stone

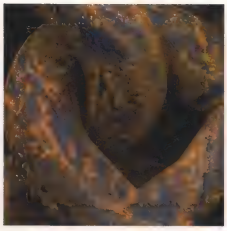
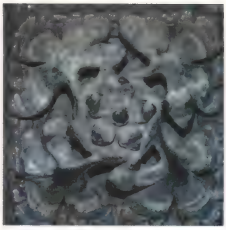


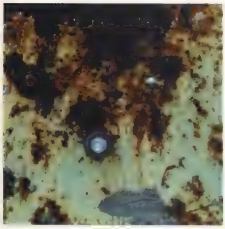
Brick

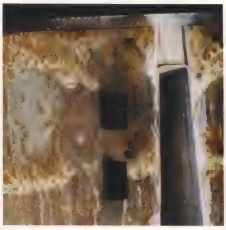
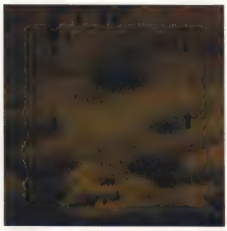
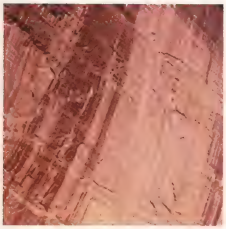
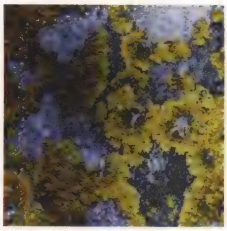
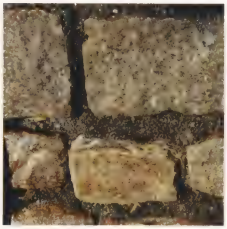
Wood

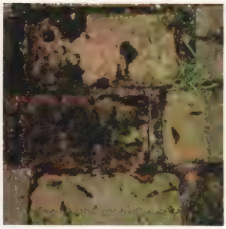


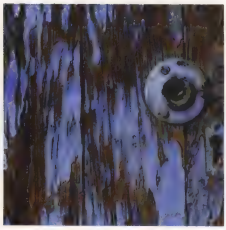




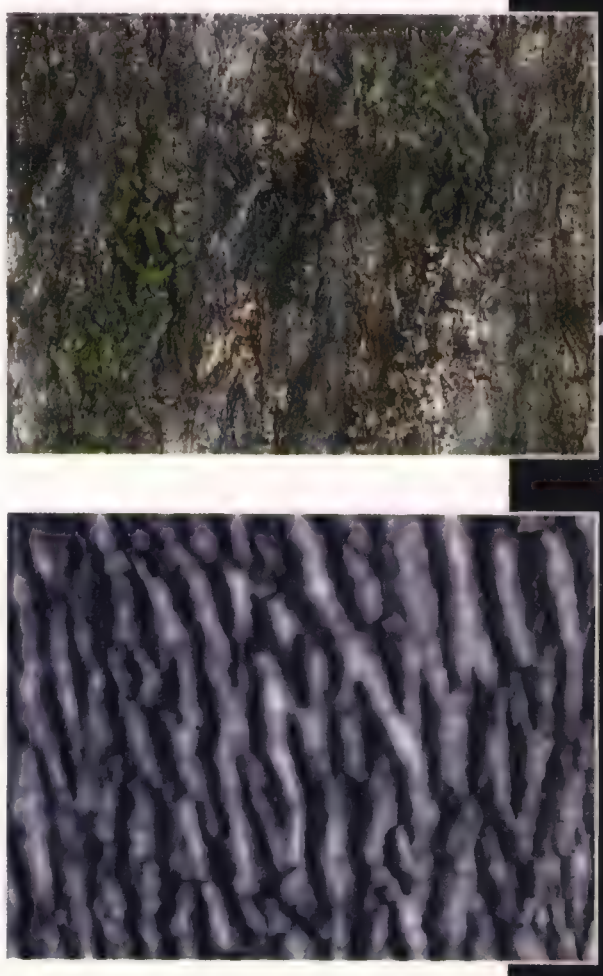




In addition to a map of a surface texture, several other specially created maps are applied to an image, giving it its three dimensional appearance: a color map, which simply applies color to an object; a bump map, which adds irregularities to the surface, creating all manners of impressions: grooves, cracks, ridges, and, of course, bumps; a specular map, to indicate specific areas of lighted highlights in a given object, say a round ball; and a reflectivity map, which tells the computer how, where, and to what degree light is reflected from the object's surface.

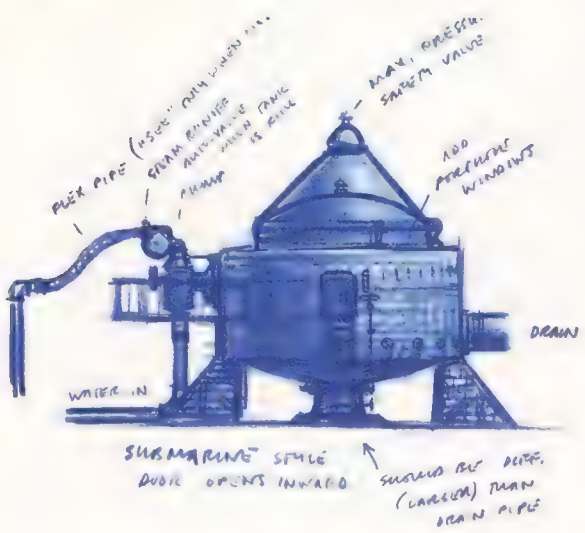
Michael Bostick

As the artists became increasingly adept at creating and applying these maps, they found that in certain cases the right use of one or just a few of the maps could produce a complicated effect and save time in the process. Though it looks as three-dimensional as any of *Riven*'s other "sets," the bark of the giant tree stump on Prison Island, built by Tony Davidson and Robin Foley, is a great illusion, since it is achieved from a simple bump map and color map applied over the smooth object. On its own, a bump map looks like a gray-scale version of the full image. The different levels of gray—all the way from dead black to white—correspond to the relative depths of an object's surface and tell the computer how high or low, in a physical sense, to render different parts of the image. The lighter the area, the higher that part appears. By exaggerating the light and dark areas on the giant tree's bump map, Robin created the impression of deep grooves and cracks, giving the wood and rock a petrified, prehistoric feeling. "If you use a bump map right, it can trick the eye into seeing more detail than is really there," says CG artist Michael Bostick.



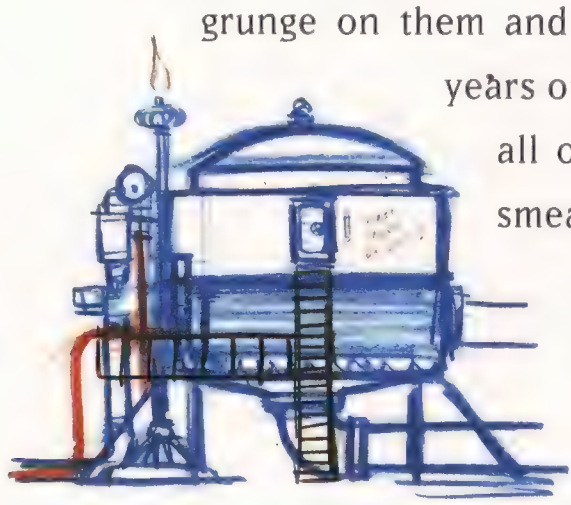
Prison Island in *Riven* is the stronghold where Catherine is confined. The prison itself sits atop a massive tree that has been hacked off at its base, no doubt for Gehn's bookmaking experiments. The core elements of the design for this wretched outpost are seen here, including the color (above right) and bump maps (below right) applied to the shaded model (far right). The finished design appears on the following spread.

View of Catherine's prison from the top of the stairs leading to the elevator.

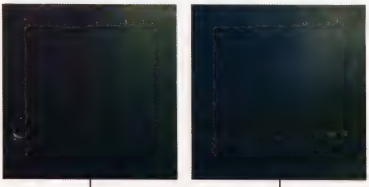


Concept designs for the huge boiler on Book Assembly Island. The sketch at right is closer to the final design seen in the game.

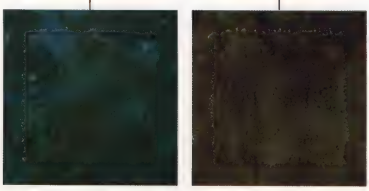
As with every other aspect of creating *Riven*, Cyan's greatly expanded resources and computing power allowed the designers and artists to push to rather extreme levels of detail and uniqueness in creating the textures to be applied to the models. In *Myst*, the surface of a tree, for instance, was composed of a small section of barklike texture repeated as many times as needed over the model of the tree. With *Riven*, in addition to creating much larger maps, a texture composed of seemingly repetitive materials would, in fact, consist of an untold number of uniquely customized surfaces. The boiler on Book Assembly Island, which Gehn uses to turn trees into pulp for paper, is a case in point. A look from closeup on the catwalk surrounding the boiler reveals that in every place careful thought has gone into designing the textures that cover the model. Levers are not just metal colored. They have grunge on them and are worn down in the appropriate places from years of handling. The bricks are pocked and discolored—all of them differently! And the assortment of drips, smears, and corrosion that have been applied to the metal pipes and plates is, simply put, excessive. But Cyan wouldn't want it any other way. They want the player to experience this boiler as if it were real.

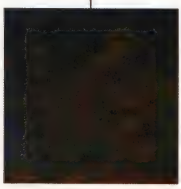


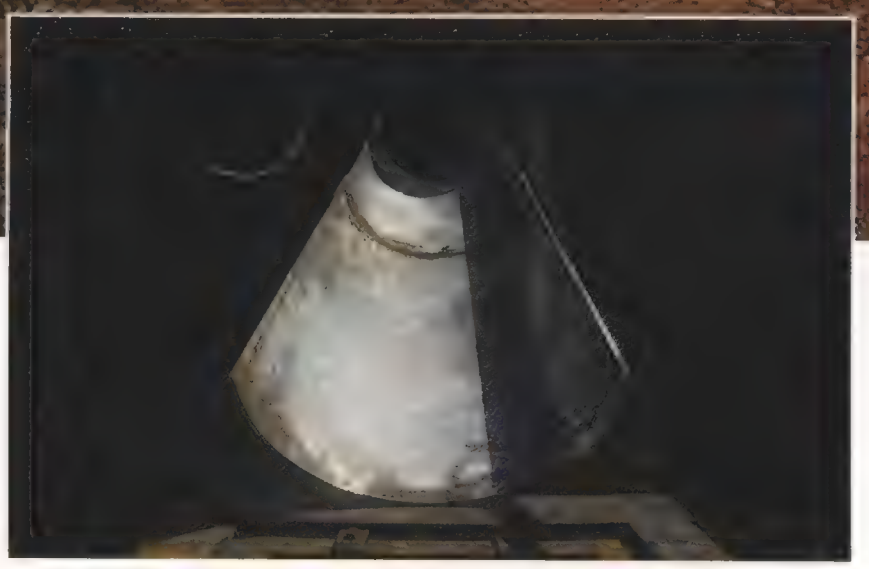
A simple comparison between the texture map for a brick covered wall in *Myst* (near left) and for the one on the boiler in *Riven* (left) reveals a multitude of differences in the design of the two games. For example, the *Riven* map is many times larger, and so is repeated less often, and the detail is phenomenal, right down to the uneven mortar job applied to the bricks.



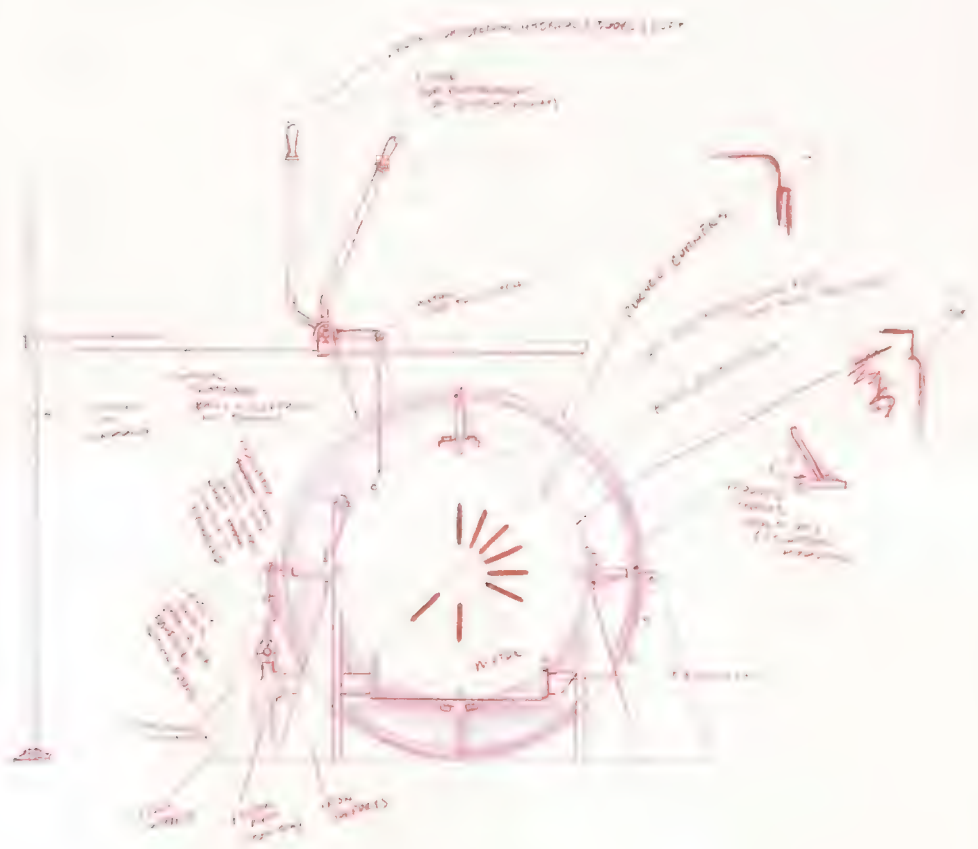
Well over forty separate texture maps were used to create this closeup shot of the boiler. While many of the surface effects were achieved with a single map, as with the rubber boot on the left, the appearance of the metal handles and the pipes, for example, were the result of combining a number of textures together.







The log chipper on Book Assembly Island (seen above in its final form and below in concept sketch) is designed to chop down the trees for pulping into the paper Gehn uses to make his version of an Age book.



The realistic flaring of light off the metal chute of the chipper was created by applying a custom designed shader program. These programs were used throughout the game to produce natural looking effects and were the difference between an object looking flat and ordinary and an image that stands out for its remarkable illusion of reality. A comparison of one view of the chute with the shader applied (above) and without (top) speaks for itself.

Shaders

If you look carefully at the lake near the boiler on Book Assembly Island, you will notice that the color and opacity of the water changes depending upon its depth as well as your angle and distance from it. Take a look at the chute that brings logs down to the massive chipper next to the boiler. Again, depending upon your angle of vision, the light glares off its metal surface in ways that subtly recreate how light actually reflects off shiny surfaces.

Karl Stiefvater

"To make a good looking metal," explains *Riven*'s computer graphics technical director, Karl Stiefvater, "the artists must do more than just paint a realistic texture. A texture will look good only from one particular angle, in one particular lighting situation. Change the environment and the surface will look very out of place." In certain instances, *Riven*'s artists did not fully anticipate these moments. The submarine on Jungle Island, for example, was originally designed for an underwater shot where the metal surface was obscured by the effects of the water, but the moment the sub was placed in sunlight, it's surface simply fell flat. Compared to the riveting, brightly lit scene surrounding it, the sub looked as if it had actually been painted, cut out, and pasted into a photograph. To overcome the limitations of the basic texture maps, Cyan's artists utilized custom "shaders," which are special programs that produce all kinds of vivid and highly realistic natural effects. While many software packages come with a number of built-in shaders, they were often disappointing to Cyan, falling far short of the standards they set for *Riven*. Instead, they turned to Karl to design custom shaders that would create the effects they wanted.

There are many images in *Riven* where the underwater terrain is defined by accurately reflecting the effect of water's transparency depending on its depth (see below). These touches are part of the many separate details that add up to *Riven*'s entire world coming to life visually.

Of all the natural effects computer artists have been recreating in recent years, with varying degrees of success, there is perhaps no harder one than water. In *Myst*, the illusion of water was limited to the flat plane, a color and reflectivity map, and a bump map. With *Riven*, all that would change. Karl created three special water shaders for the new game: the "ocean" shader simulated realistic, adjustable waves over large bodies of water and had a variable looping option; the "water" shader modeled the physics of the reflective, transparency, and coloration properties of water;

Without any of the custom shader programs, the surface of water would look like a mirror with no ripples or waves (above). While a bump map for water, such as the one below used for the original *Myst* can add some of the impression of water's natural look, it has a very limited effect.

and the "submerge" shader provided the underwater depth fading effect, in which the vertical light falloff from the water's surface is taken into account. When used together, particularly for underwater shots, these three shaders produced extraordinary results.

"The custom shaders really saved us," Says Robyn. "We could never get the water right with the shaders we started with. But once Karl wrote one that worked, we kept asking him to do others." In all, Karl developed two dozen shader programs for *Riven*, with effects relating to landscapes, mist, lighting, water, and various materials. He has since left Cyan to start his own 3-D graphics software firm, Lume, Inc., specializing in—what else?—custom shaders.

By combining shaders with the texture and bump maps, *Riven*'s artists were able to create all kinds of startlingly lifelike scenes involving effects that mirror what you see in the real world. While it assumes a knowledge of the physical properties of all kinds of materials and the effects of light, creating an effective shader program must take into account the intentions of the artist as well. "Making a good shader requires the cooperation of an art-minded and a science-minded person," Karl says, summing it up. "The art-minded guy paints the scene and determines what it should look like; the science-minded guy writes the shader that makes it happen."

This underwater shot of the swimming sunners demonstrates the results produced by the three water shaders developed by Karl Stiefvater.

The Ocean shader creates the impression of ripples and waves on the water's surface and adds the highlights of light caused by reflections.

The Water shader handles the water's reflectivity, transparency, and coloration in relation to the varying distances from the camera.

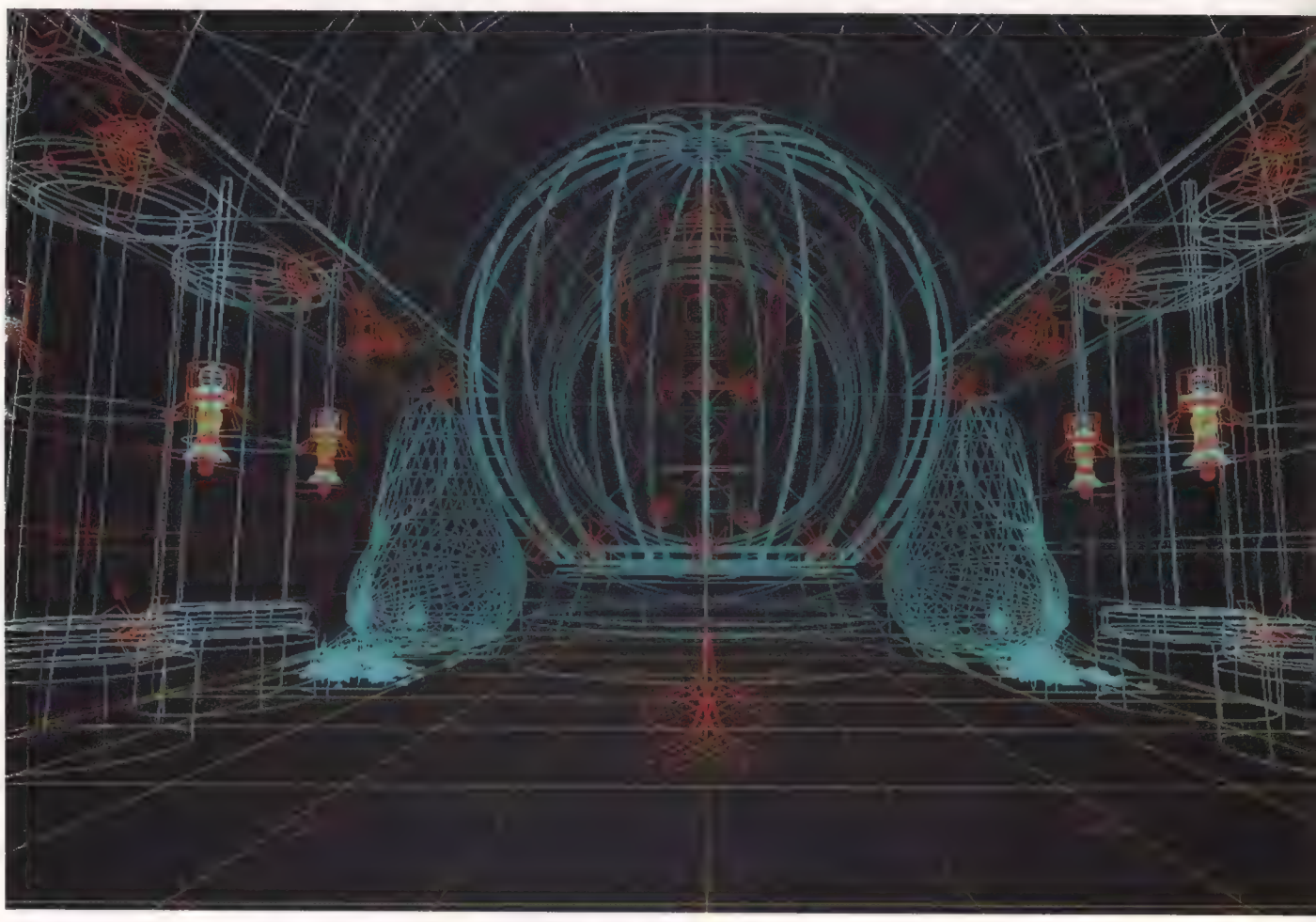
The Submerge shader produces the falloff effect of light as the distance from the surface increases.

Lighting

Once all the objects for a particular image were designed and constructed and the basic scene assembled, the next crucial step involved determining the quality of lighting. Because the game's settings were so elaborate, they were as challenging to light as a real movie set. Cyan's artists used light—both natural and artificial—to establish mood, to accentuate or obscure objects, and to add the final layers of detail that would visually sell a scene. Apply the lighting in the wrong way and the scene would be robbed of its realism.

The interior of Gehn's temple on Temple Island was lit by Tony Davidson in the most powerful fashion to create a mysterious, almost claustrophobic atmosphere. The game's shot of the room is dominated by a backlit stained glass window bearing his crest. The window isn't simply lit—the light appears to burn through the glass, creating a halo of glare that scatters around the glass in the most realistic way. The light even cuts into smaller bands as it passes through the bars of the imager situated in the middle of the room.

When it came time to light the scenes in the villager's school room underground on Jungle Island, Josh Staub began by setting up individual lamps at intervals throughout the room. Rather than a single point source shining in a focused direction, a sphere of sources, like a bulb, was arranged within each round lamp. Because of the dark animal patterns applied to the surface of the lamp itself, the software knew to cast strong, crisp shadows in crisscrossing



Gehn's Temple Room in wireframe mode (below), with the various light sources, indicated in red, set in position around the room. In its fully textured state and the lights turned on, the room has a cool and gloomy cavernous feel (bottom left). With all the final effects in, including the glare shader (bottom right), the flat quality of the light has been transformed to heighten the contrast between light and dark and to concentrate attention on the stained glass window.

patterns against the walls but without taking into account the balancing and diffusing effect of the various lights upon one another. To achieve a more realistic effect, a technique called area lighting was used to create a proper balance. The soft, blurred shadowing now generated by the lamps around the room enhanced the setting's cavelike feel, which was the intention in the first place.

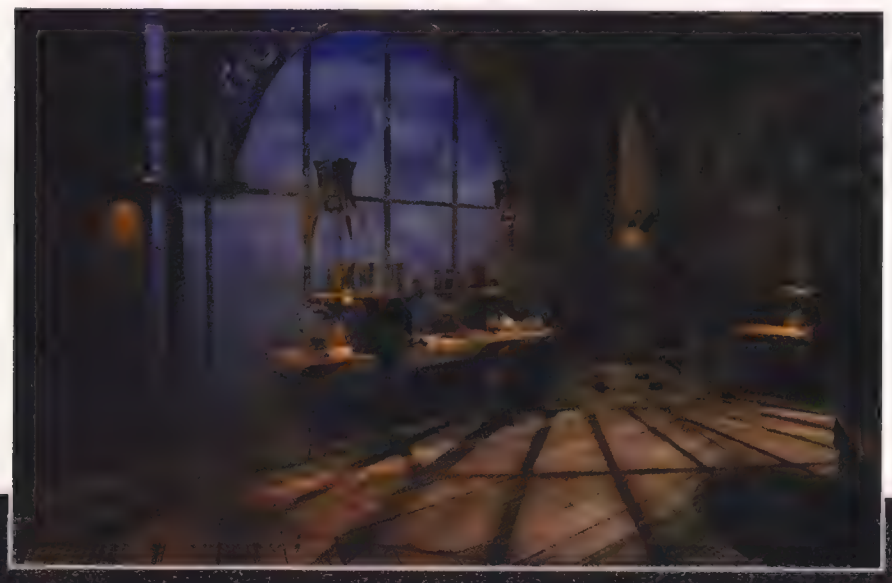
To produce an extremely dramatic effect in a scene, *Riven*'s artists resorted to a classic technique of the theater: the spotlight. For instance, in any of Gehn's fire marble domes—good luck opening one!—your eye is powerfully drawn to the Linking book resting on a pedestal at its center by the intense spotlight shining straight down from above. A shot like

The village schoolroom on Jungle Island with and without area lighting turned on (above and top). In the center of the scene between the lights stands one of Gehn's imagers. When cranked, the player views a recorded image of Gehn delivering a formal greeting to the students.

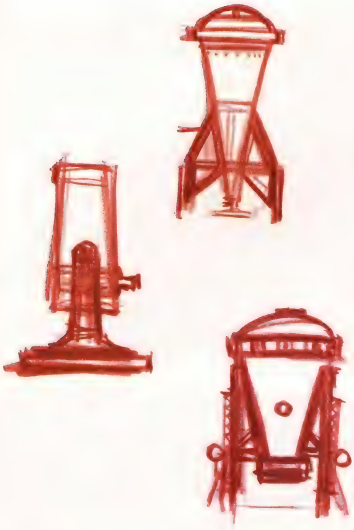
While the exterior scenes in *Riven* offer grand and imposing spectacles, the interior shots—including inside a fire marble dome (right), Gehn's lab on Book Assembly Island (below), and the tunnel to the Wahrk Throne Room on Survey Island (bottom)—are just as beautifully crafted and are distinguished by a powerful sense of what lighting can do to create drama, draw a player into the surroundings, and lead him towards a destination.

this employed far fewer light sources, but it required the artist to wield a delicate artistic touch along with knowledge of the software to specify just how much of the scene would be dominated by the dramatic ray traced spotlight and how much detail would remain barely visible in the background.

In spite of the ability to play with dramatic effect and the tone of artificial light, or to create natural light streaming through a window, it's quite difficult to light an indoor scene since it requires the manipulation of as many as 20 to 50 light sources. An outdoor scene, by contrast, is much easier. Yet, it still demands an accurate eye for what appears to be natural sunlight. The degree to which sunlight, in a given situation, can be altered is very slight. It's simply going to look real or it won't.



Riven's sunlight, in fact, was composed of four separate lights. For the sun itself, there was the single extremely bright light that pervaded the entire shot. To balance the raw strength and color of this main light and to keep a scene from bleaching out, a combination of tone lights were added: a blue one to add color to the light and some coolness to shadow



The telescope on the fissure plateau in concept form (left) and in a series of the same shot (right) with the different lights that make up sunlight turned on. From top to bottom: main sun light only; blue light only; two bounce fill lights only; and the final game shot with all three lights turned on simultaneously. While the blue and fill lights are by themselves extremely subtle, they are still an integral part in creating a realistically lit scene.

areas along with two separate fill lights placed at opposite ends of the shot, below the plane of the surface. These fill lights provide warmth to the main light, reduce its bleaching effect, and create the impression of light reflecting into areas hidden from the main light's path. This helps illuminate some of the detail in the darkest corners and crevices which otherwise would disappear into blackness.

Lighting *Riven*'s thousands of shots, whether indoor or outdoor scenes, required hours of careful set up and review. The brilliant natural effects were achieved not only with custom designed shader programs but also by Cyan's decision to render every single shot with ray tracing, a method that actually traces the paths of light from their sources in a given scene while calculating the variations in shade, color intensity, and shadows produced as the light passes through and around objects and reflects off different materials. Typically, *Riven*'s scenes each contain up to 40 or more ray traced light sources, all of which had to be calculated separately by the computer, requiring massive amounts of power—and time—to calculate the true shadows, reflections, and refractions ray tracing provides.

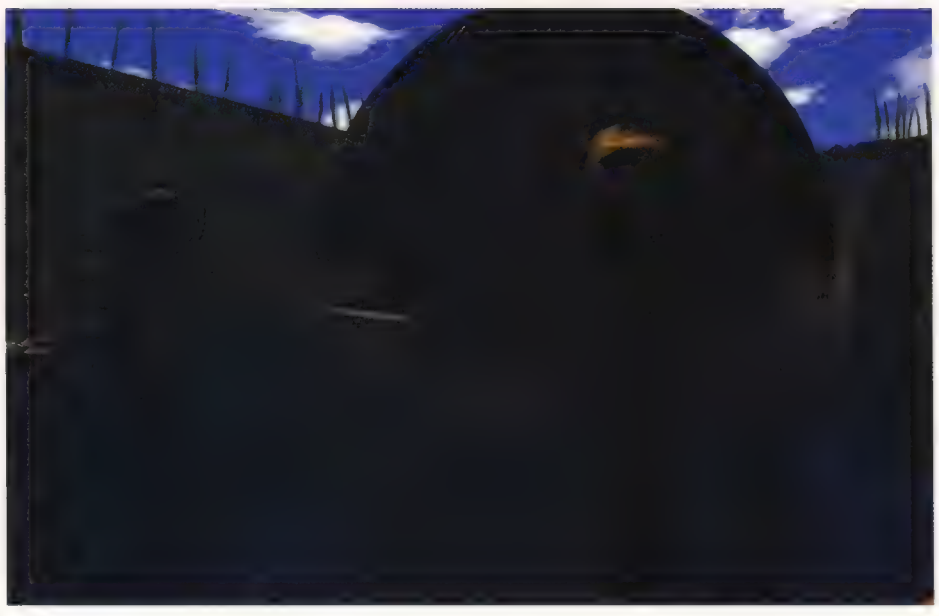
"Some cheats are possible," says Josh Staub. "But nothing substitutes for ray tracing. The final results are almost always worth the effort."

Two views on Survey Island reveal opposite ends of the island's perspective. Position "A", as indicated on the map (opposite far right), offers a view of the island looking through the bladelike rocks toward the plateau's face. Position "B" is on the overlook and gives the opposing view with the rocks in the far distance.

Scene & Setting

Glancing at the surface of things, *Myst* and *Riven* might seem more of a technical achievement in computer artistry and the finepoints of modeling frames for objects and designing surface textures and shader programs to reflect hyper-reality. It is very easy to focus exclusively on the cool factor of what you see and to overlook what is the underlying key to the success of these games: they are story driven. What really sucks the player in is that there is a deeply felt *purpose* to playing the game.

The fact that the creators have gone to such lengths to develop a plot that is interesting and which ties in to their development of D'ni culture and history is still, however, only one part of the game's design. What the game—as a whole—must do well is to combine the separate features of story and computer artistry in a smooth and seamless fashion. More than any other aspect of the game's construction, the scene planning and relation of scene to scene as the player moves is the single most crucial element to bringing the whole show off. If what you see as you click and turn your way around—and the *way* you see it—doesn't subtly reinforce your emotional and psychological interest in the story, then the game would disconnect into a fragmented miasma of neat but ultimately lifeless images.



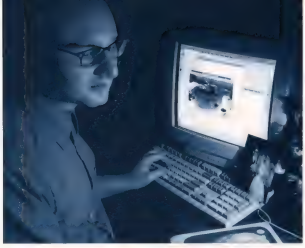
The key for *Riven* was an acute, often exaggerated, sense of visual continuity. "That and a lot of visual cheats," says Michael Bostick. What you see—the "camera eye," in movie terms—is often distorted. While the camera floats about six feet off the ground, which is similar to how movies are shot, frequently your field of vision is much wider than it is in the real world. Furthermore, when the camera makes a ninety-degree turn, it actually takes several steps back at the same time to give the player the widest field of vision appropriate to the shot. In many cases, if the camera eye's pivot point did not move back, the player might find himself staring at a wall from six inches away.

When turning left or right from, in this case, the middle shot from a scene on Survey Island, the game's designers have made sure to connect similar visual information at the sides of the adjoining shots, so that the player can set visual landmarks and maintain a sense of where he is at any given turn.

To achieve continuity and allow the player to keep track of where he is in a given moment, each scene always includes some overlap from frame to frame so that the segments of each turn are visually related. The use of perspective, as well, has been altered in ways to enhance visually what you might only understand physically in the real world. When walking down stairs, for instance, the camera is angled steeply down toward the direction of movement to oversimulate the sense of forward motion. Normally, your eyes would stray around in all directions while your feet carried you down.

Cyan's own virtual stuntman—known as Harold—was frequently dropped into scenes to check the scale of objects as seen from various distances as well as the camera's eyeline to make sure it was the same height as Harold's line of sight.

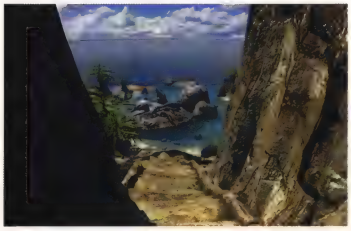
To compensate for the fact that in designing shots separately, often by separate artists, the scale of the surroundings might be different from one view to the next, a virtual stand-in—a six-foot tall computer-generated dummy—was employed. This non-union guinea pig was perfect for dropping into scenes to make sure that all the props and sets were in proper scale and that the eye line the artists were using for the scene matched with the eye line from the previous scene. It would be pretty jarring to see



Jeremy Engleman

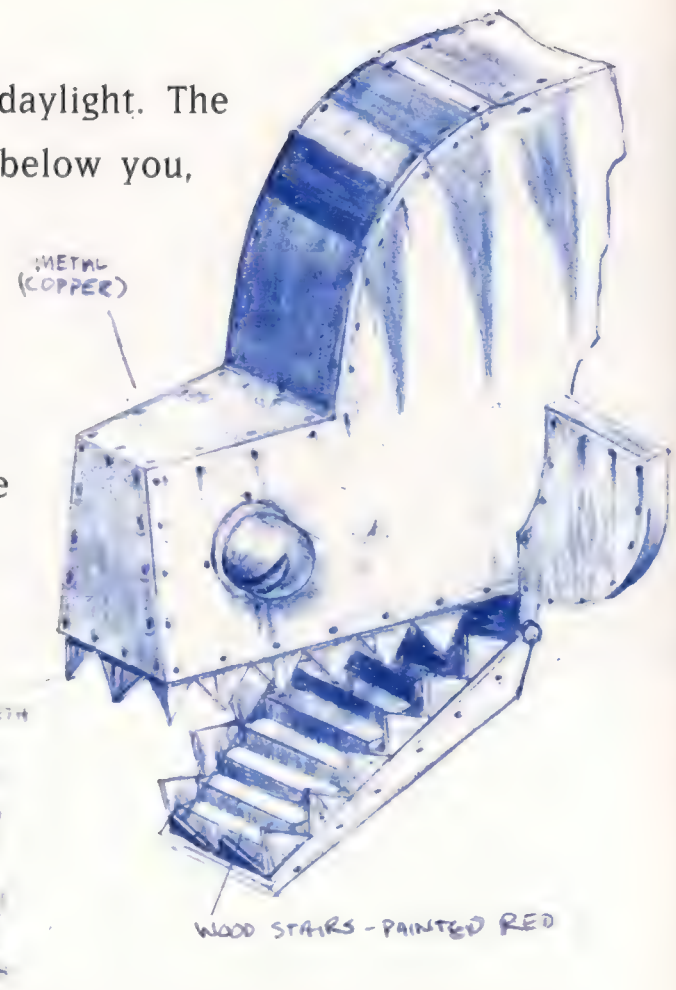
the world from six feet off the ground in a hallway and suddenly find yourself eight or ten feet in the air after entering a room. It would also not make very much sense if the player having, say, moved a lever in one shot, turned around in another only to find the lever back in its original position. Because the player can *change* things in the game, the designers went to some extraordinary lengths to make sure every possible combination of events was included, so that there would be no break in continuity.

While the transitions between scenes is important for maintaining a concrete sense of place and perspective in the player's mind, it is equally significant as an opportunity to create dramatic tension and heighten the emotional response of seeing. *Riven* takes full advantage of these moments. A good example is the walk down to the sunners lagoon, modeled by Jeremy Engleman, on Jungle Island. You begin in daylight by moving down a set of stone stairs cut through a solid wall of rock. As you progress, the rock walls climb higher around you, until it almost feels as if you are in a cave. The light has vanished; sounds have deadened. The sense of the island as a whole has diminished to this claustrophobic crack in a dense slab of granite. Then, barely visible ahead, a crescent of light shines faintly around a bend in the path. The light begins to pull you through the gloom. The sound of wind and water slowly sharpens.



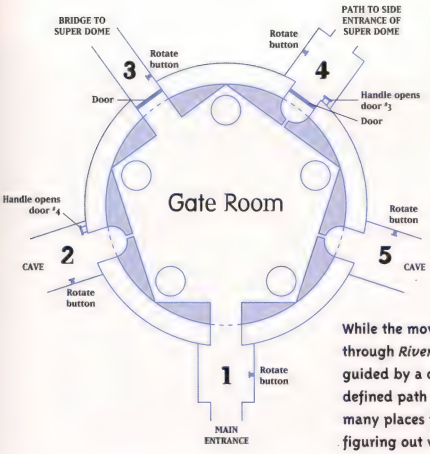
This series of images (from top to right) follows the path down to the sunners lagoon on Jungle Island. Approach too fast or make a noise and those sunners will take right off, which is too bad since they provide an important clue.

Gehn's Wahrk Totem is meant to keep away the villagers, who have a great fear and respect for the sea creature, and to guard the entrance to Gehn's secret underground on Jungle Island.



Suddenly, the scene opens up into full daylight. The broad expanse of the lagoon is directly below you, with two enormous sunners catching some rays on the rocks just above the breakers. You're in the open again, able to see and breathe, the tension broken.

The transitions between shots were designed to enhance moods in other ways. As part of the creator's intentions to blend story, character, and settings more finely, you are keenly aware on a grand scale of how things change when moving from an environment dominated by one character to a setting related to another. Gehn's domains, for instance, have a brutal aspect; the objects are hard edged, often chaotic. The wahrk tusks standing like grim sentinels and the rock slabs like giant knife blades on his Survey Island stand out in stark contrast to the softer look of the Rivenese village on Jungle Island. Even the Rivenese's decorations, such as the wahrk totem, blend into their environment in ways that Gehn's would never do. Without overtly stating it, these sets tell us a lot about the characters that inhabit them: Gehn imposes

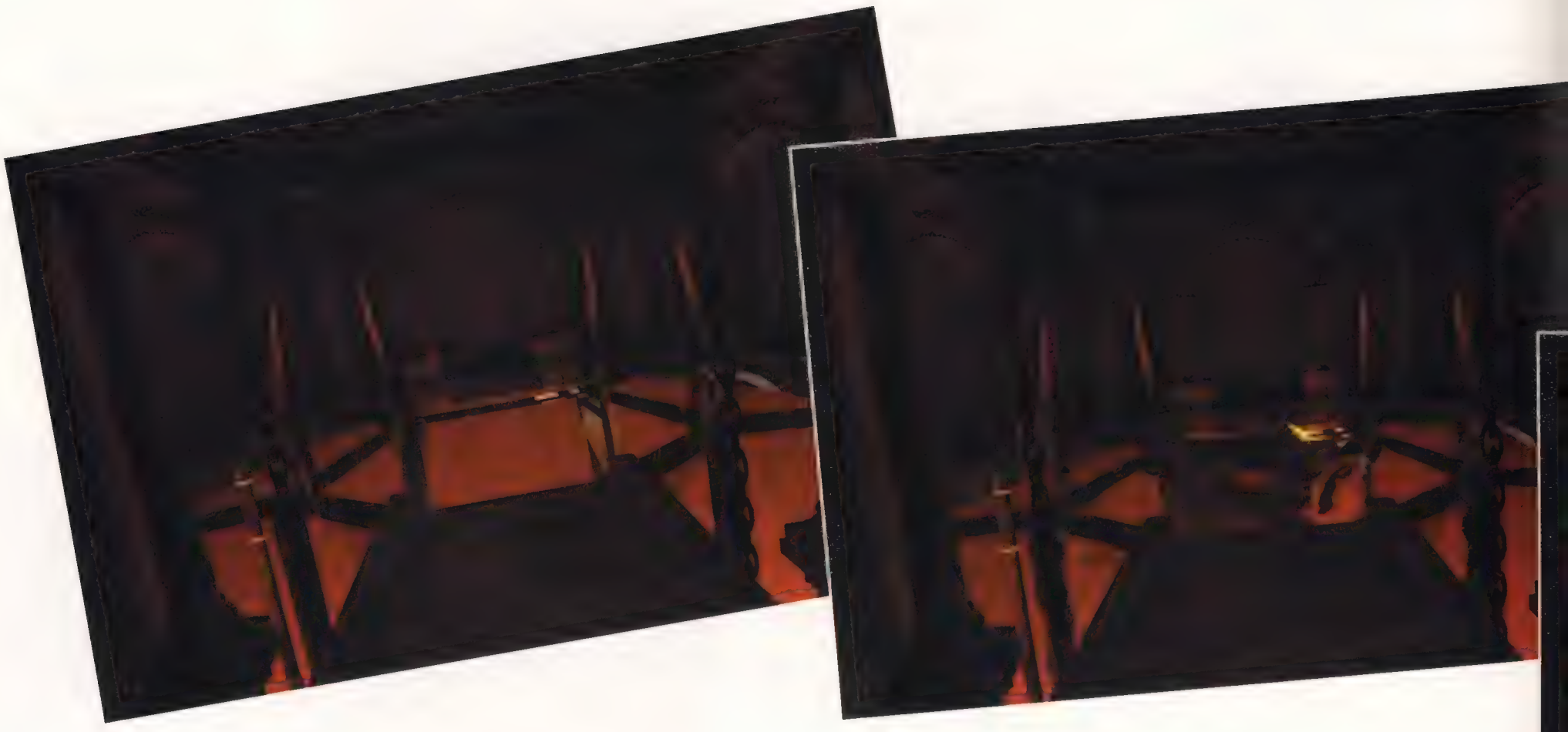


While the movement through *Riven* is often guided by a clearly defined path there are many places where figuring out where to go and how you get there is no easy task. The Gate Room on Temple Island is a perfect example. A schematic (above left) reveals that the room is five-sided with two inner doors and three peep holes. And, it rotates. There are five entrances each with a door (labeled 1–5) and a rotate button. Entrance 2 has a handle that opens the inner "grate" door at entrance 4, and entrance 4 has one that opens the inner door at entrance 3. The objective is to rotate the room and gain access to either the bridge or path that leads to the superdome. The three smaller schematics (above right) show the rotated position of the room with arrows indicating your position while the view to the left of each shows what you would see.

Closeup views of the watch, opened and closed, found on the table beside the bed in Gehn's Age (top). The maplike carvings on the watch's metal surface were inspired by ideas about where the D'ni civilization may have once lived.

his will on his environment, while the Rivenese—along with the rebel Moiety—have learned to live in harmony and blend more with their surroundings.

By providing carefully selected opportunities to focus up close on smaller details—as intricately designed as the larger views—the creators have gone even further to produce a more intimate level of involvement than achieved by simply passing through a larger field of vision. As in *Myst*, it is often possible to peruse through the drawers of a desk, open a box, or turn on a gizmo without it being essential to progressing through the game or solving the final puzzle. Everyone now knows, of course, that to leave anything unexplored might mean overlooking some important clue. But the rewards in *Riven* are often in what is merely a small detail that has nonetheless been conceived as intricately as any of the larger landscapes or objects. On the bedside table in Gehn's bedroom, for instance, the player will discover Gehn's timepiece—one of the most interesting items in the entire game. Besides being beautifully crafted, it has been animated to slide open at the player's touch, revealing another layer of detail in its splendid design. As the watch closes, it does a slight roll, as if your hand had just brushed it.



Animation

From the very beginning, Rand, Robyn, and Richard were clear they were going to raise the bar on the quality of animation the player encountered in *Riven*. As with *Myst*, the designers would do what they could afford to do, and whereas before the animations of doors opening and levers flipping had a slight crudeness to them, now everything would swing, rotate, flip, depress, and rise up in smooth, gliding motions. And to keep all of *Riven*'s environments as dynamic as possible, as many natural effects would be animated as time would allow—wind rustling through leaves and waves rippling across water—not to mention that there would be live animals as well. On top of everything, there would be a wealth of subtle motions—rolls and undulations—added to objects that reflected a sensitivity to natural physics—all intended, as Robyn puts it, "to keep the scene alive."

On top of all the complex and extended animations *Riven*'s artists produced for the game, they also took the time to include a number of small touches that added a significant measure of reality to the scenes. Particularly with an inanimate object, including

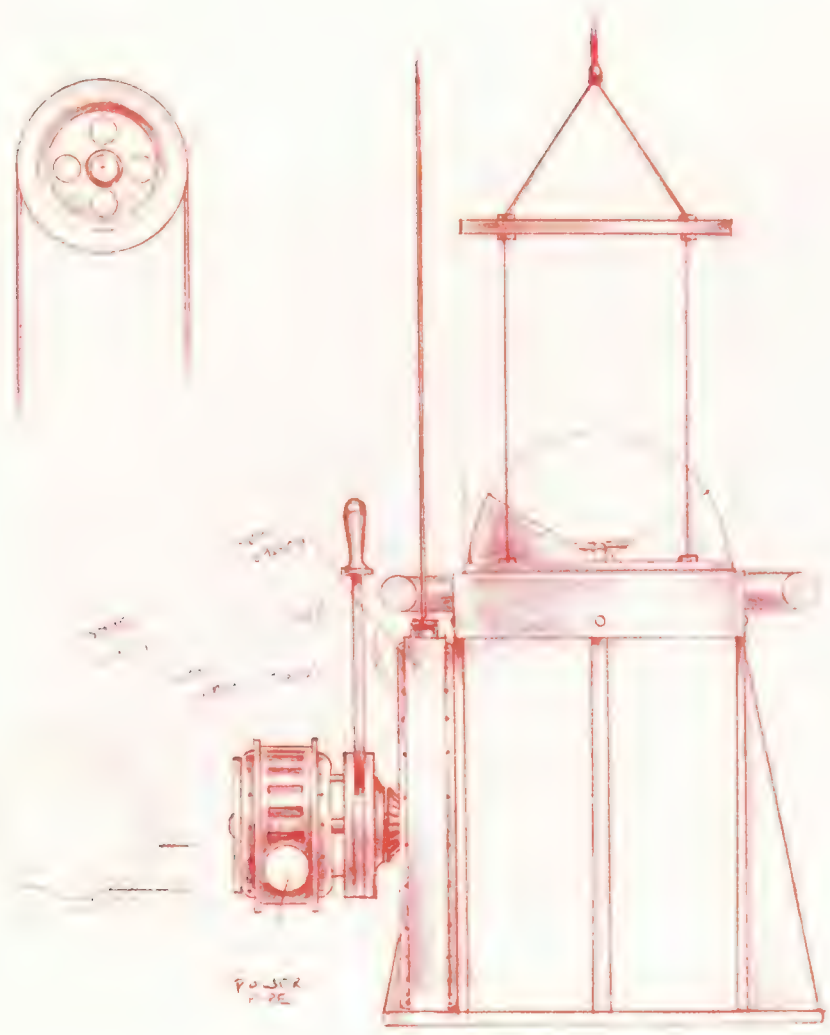
(above, left to right) the submarine, the bridge on Temple Island, and the pistonlike device in the superdome, the merest shake, vibration, or flexing was enough to bring it to life and keep the scene from seeming superficial.

This is where their decision to create the game using SoftImage really paid off. "It's an all-inclusive environment," Richard says. "You can go straight from modeling to lighting to animation." In SoftImage, the designers could build any object to be animated using the same process they followed for a static model: constructing a wireframe skeleton, covering it with a variety of texture maps and shaders, if necessary, and setting the lights. With a finished object or scene, the animation was then added and locked into place.

This series of images of the animated elevator on Survey Island suggest its breathtaking visual impact: the gradual increase of chain movement, the elevator spinning around as it rises out of the water, and the dramatic flash of light reflecting off the door panel as it opens—all as subtle ripples and reverberant drips of water breath life into this inanimate object.

While many at Cyan had plenty of experience making doors swing open, buttons depress, and elevators ride up and down, the creators had set themselves some pretty high goals for animating the organic forms in *Riven*. And animating organic forms is notoriously hard. Machines move in repeatable, predictable ways, but the human eye is very sensitive to unnatural motion in something that's supposed to be alive. Patrick Faille animated Richard's wahrks, modeling their movements to Richard's strict requirements after studying videos of whales. Eric Vignola animated the sunners, endowing the strange sea creatures with some of the birdlike qualities that were their original inspiration. In creating and animating all of these odd creatures, it was not aesthetic reasons alone that inspired the artists. Consistent with the game's overall design, *Riven*'s animals provide major clues to solving certain puzzles. The sunners' throaty bark, for instance, is a sound the player must remember in order to connect

Tim Greenberg

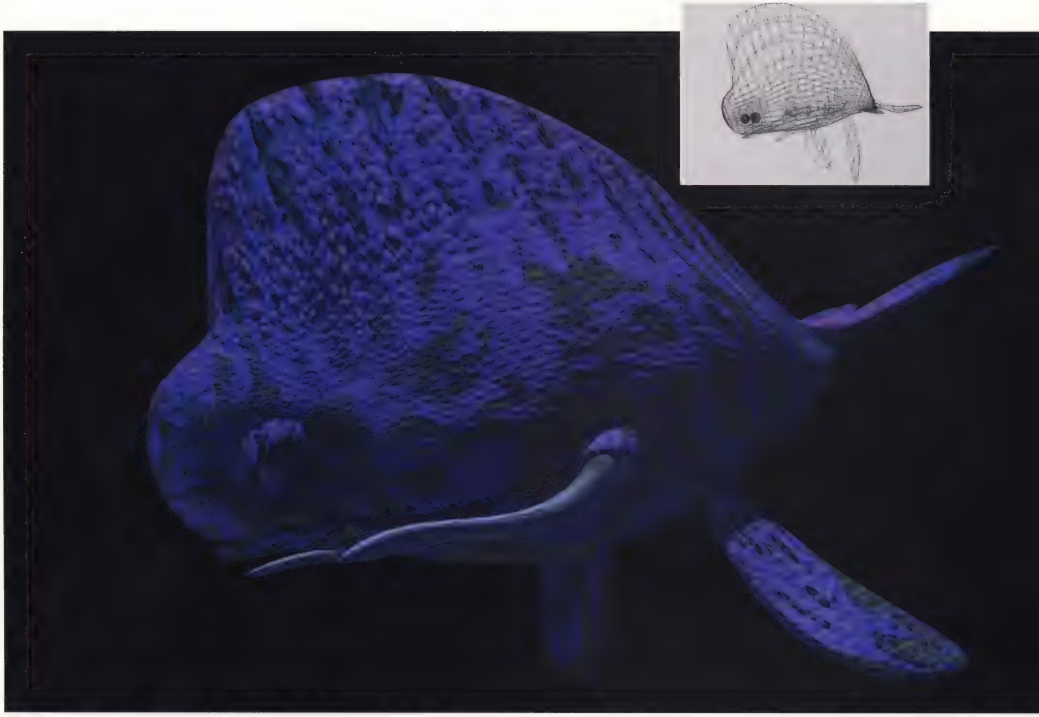


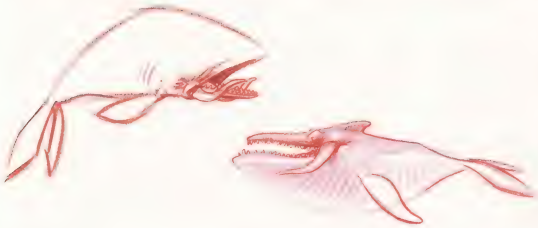
The froglike Ytram (below) is another of *Riven*'s original creatures. In keeping with *Riven*'s emphasis on revealing character elements, the Ytram serves a very special function, at least for Gehn. Using the elaborate trap (seen in concept form and final design), he captures the Ytrams and distills them into a purified juice which he then smokes in his signature fire marble pipe.

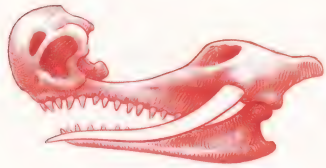
Several of Richard Vander Wende's concept sketches for the Ytrams (below).

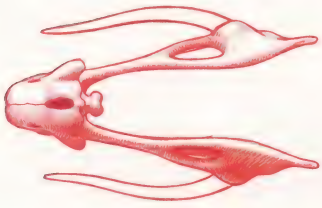
the sunner to a revealing piece of information. Getting close enough to hear them, however, is another one of those typical moments when you have to figure out how to do it because those big swimming birds keep disappearing if you're not careful.

The submarine ride on Jungle Island, which allows the player to travel around the bay, is one of the game's major animations. It combines both moving organic and inorganic forms and represents the massive team effort that went into making *Riven* work. "The submarine is one of Gehn's funkier inventions," says Richard. "It moves sluggishly around the bay floor, sort of

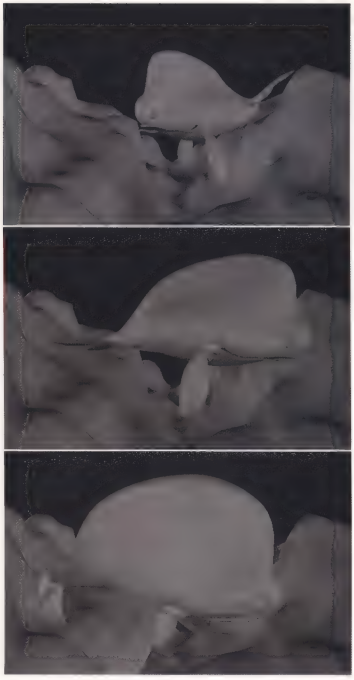




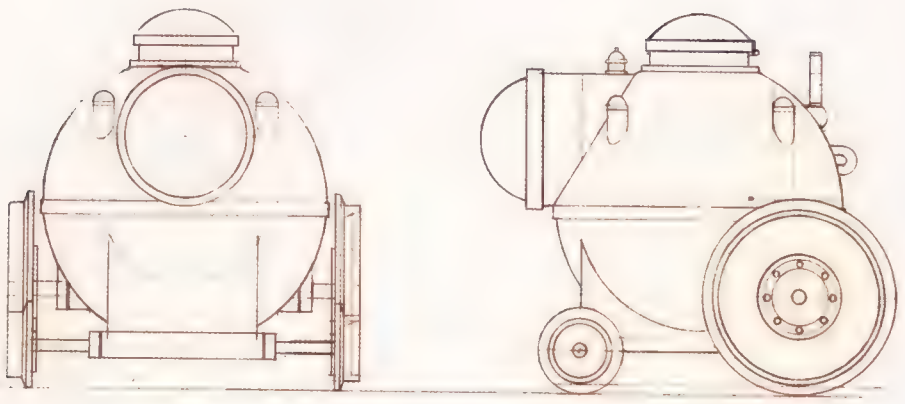




The carnivorous wahrk (fully rendered in the top image) prowls the oceans—like some mutant Moby Dick—waiting for Gehn to toss him scraps. The designs on this page include Richard Vander Wende's sketches (left), a wireframe model (top inset), and several shots from an animated sequence rendered in shaded polygons for checking (right).



The concept sketch for the submarine (below) found on Jungle Island appears almost unchanged in the final scene from the game (bottom). The only features added were the handles.



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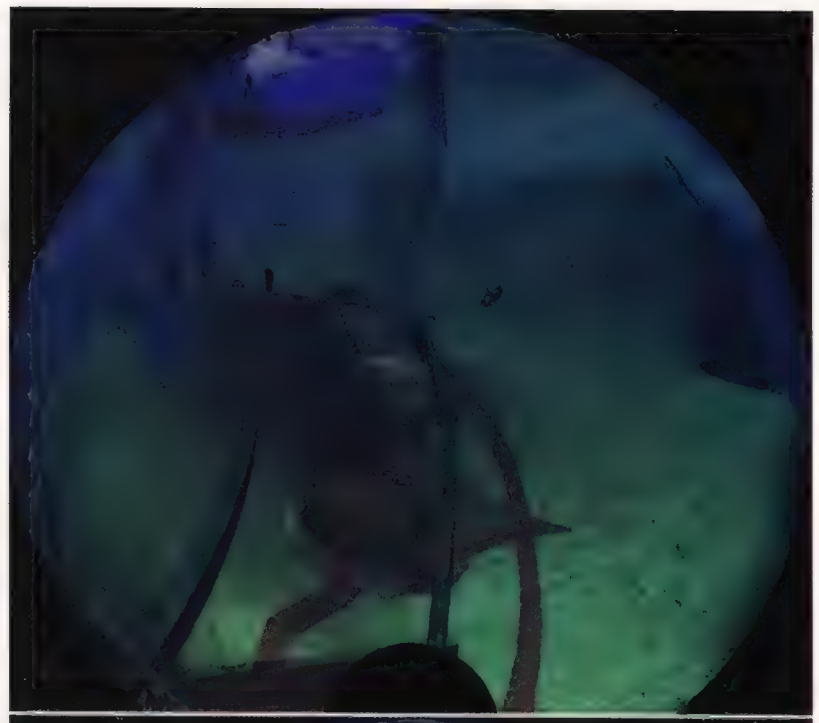


like a cross between a fork lift and an old railroad hand cart." Originally, Robyn and Richard had intended to create a boat, but subjecting Gehn to the whims of wind and water seemed out of keeping with his control-freak personality. Richard changed gears and designed a crude submarine, which he handed off to Robin Foley and Bret St. Clair for construction. Tim Greenberg and Bret built an elaborate model of the bay floor for the sub to move through, and Tim went on to animate the ride itself while Bret animated the swaying movement of the underwater plants.

Not everything that you see moving in *Riven* is animated, however. For certain scenes, where they felt they could get away with it, programmer Mark DeForest used a programming trick known as a runtime effect. As opposed to animation, a runtime effect is a small program written to

Once inside the submarine, the player follows a path underwater around the lake to the schoolroom, guard tower, Wahrk Gallows, and repair depot. Along the way, the player is treated to a watery adventure that includes passing through these strange columns of air generated by thermal heated gas rising from the ocean floor.

manipulate the background pixels in a scene. A number of these were used throughout *Riven* to add movement to images that would otherwise have been static. The twinkling of fireflies, the buzzing of blackflies, the random tremors that signal the slow breakup of Riven's islands, and, most notably, the movement of most of *Riven*'s water are all runtime effect animations.

Mark DeForest

Runtime effects were used instead of full animation to create the swarm of buzzing blackflies in the clearcut forest (above), which are just visible as specks against the sheared off tree trunk; for the dance of fireflies in the dark, dense jungle (right), and for the surface movement of water, as in this image from the village lake on Jungle Island (below).

Live Action

In creating the few sequences in *Myst* that incorporated video of real people, the Miller brothers resorted to the most affordable actors available: themselves. Robyn played Sirrus while Rand had the dual roles of the brother, Achenar, and the father, Atrus. In *Riven*, Rand is back as Atrus, but this time there are many more scenes depicting real characters. Atrus, Gehn, Catherine, a guard, and an assortment of rebels and Rivenese are all caught up in the action.

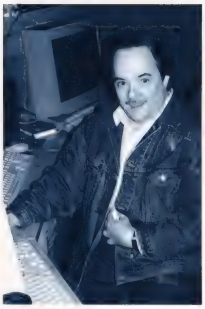
Richard Vander Wende (above, second from left) and Tony Fryman (bottom right) coordinate the action involving Gehn's guard (played by Vicente Ramos) while John Keston, the actor who played Gehn, looks on.

All of these segments were shot on video and composited along with the computer graphics into the game. Richard Vander Wende spent three weeks directing the video shoot at the PVR studios in San Francisco with Tim Greenberg acting as assistant director. Getting to that point, however, involved ten months of prep work. Richard and Tim co-scripted all the scenes, sections of which had to be translated into the D'ni and Rivenese languages developed by Richard Watson for the game. Once actors were cast, they had to learn their parts phonetically. Additionally, the scenes had to be blocked out on the computer, so that the actors movements could be accurately staged to fit the shot. Finally, they needed an assortment of costumes and props, including bolos, Gehn's dart-gun, his fire marble pipe, the guard's knife and sheath, a small rebel knife, and a scythelike rebel tool. Richard and Robyn designed these props at Cyan and then handed their detailed specs to the Seattle Opera Company's prop

Rand Miller, known to millions as Atrus, dons makeup and spectacles in order to reprise his role.

shop for fabrication.

The digital video sequences in *Riven* are a combination of computer graphics and live action shot against blue stage and screen and filmed using the Ultimatte video system. For the live action portion, as each scene was set up and rehearsed, Richard and Tim viewed the action on a monitor while the Ultimatte software simultaneously stripped out the blue screen sections of the frame and replaced them with the actual computer graphics developed for the sequence—all in real time! This allowed them to work quickly and efficiently to adjust the blocking of the scene and the placement of props. As with lighting a scene completely in the computer, extraordinary time was spent matching the lighting effects on the stage to the conditions of the computer graphics setting. Angles were checked, shadows were accounted for, and the quality of light itself was calibrated like a fine instrument to make it a seamless match.



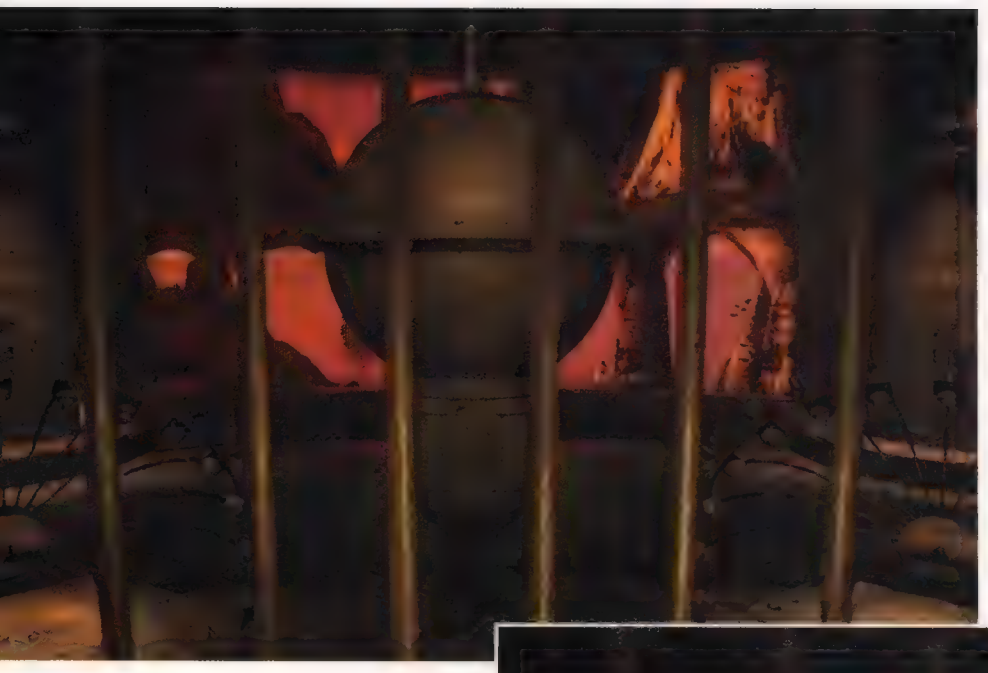
Michael Sheets

The stage crew prepares to film one of the scenes with Atrus's wife Catherine, played by Sheila Goold (left).

The filmmakers setting up to shoot the cage (below) which springs up imprisoning the player upon his arrival in Riven.

Certain scenes were more difficult than others. Upon linking to Riven, the player is rudely greeted by a cage of bars that imprison him. These bars, in fact, are both CG and real. After they rise up trapping the player, they change from CG to real because moments later a guard steps into view and approaches the cage. For this live action portion of the scene, real bars were included because the guard bumps into and reaches through them and also in order to produce the proper shadows and reflections. The guard grabs the Linking book the player received from Atrus and steps back, but he is suddenly darted and dragged off stage. A rebel appears and picks up the Linking book. He pulls a lever and disappears. The cage begins to descend, and it is at this moment that the bars change again to CG. If CG artist Michael Sheets has done it right, the player won't even notice.

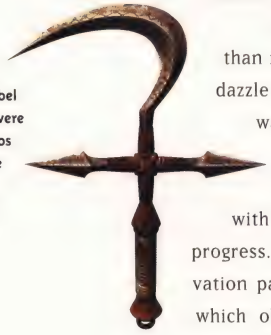
The guard enters the scene (left) and snatches away the Linking book the player has carried with him. Only the bars, the book, and the actor are real. Everything else is a computer generated effect.



The computer-generated setting for Gehn's office (top left) and the live-action film of Gehn, shot through a real set of steel bars (top right), is combined to produce the final sequence of game images showing Gehn in his office (above). John Keston (below) prepares for the scene in Gehn's office. In his hands is the rifle pictured at the top of the opposite page. From left to right, Rand Miller, Richard Vander Wende, and Tim Greenberg observe the action.

If something could not be set just right, there was always the option of tweaking it in the computer later in the process, perhaps adding some additional lighting or shadows that weren't but should be there. In one case, it was not a blocking or lighting issue that called for some creative retouching. Rather it was a problem created by scripting the scene in Gehn's Age without any cuts. John Keston, who played Gehn, found it difficult to act the long scene out in a completely satisfying manner from beginning to end. Being digital artists, however, the Cyan team resorted to "morph" editing, using Elastic Reality software to combine their favorite parts at points where Gehn was basically in the same position in two different takes. He simply morphed from one portion of one take to another in the same sequence.

As easy as Ultimatte was to use, however, it didn't solve all of the artists' problems when it came to combining video and computer graphics, particularly when the graphics involved animation. At another point in the game, as the player is making her way down a stone corridor toward the Wahrk Throne Room she sees one of Gehn's ministers duck into a side tunnel. If she chooses to follow, she eventually catches a glimpse of him inside the Mag-Lev car. Simple enough except that the car then turns 180 degrees and speeds away. This meant that not only did the animators have to place the actor in the car, but they had to match the speeds of the actor and the car animation as the vehicle turned. To do this they placed the actor on a turntable and lined him up in a set of cross-hairs which they could use later to place him properly in the computer-generated car. The turntable with the actor



Gehn's flintlock-style rifle (above) and the rebel throwing knife (right) were two of a number of props that were actually made according to carefully detailed specifications.

was then rotated at an approximate speed to match the rotating of the car.

This still left one other problem. The Mag-Lev car has a windshield. How do you stick a real actor behind a computer-generated glass window? The answer, it turned out, was simple: the glass was rendered as a completely separate shot and applied on top of the image of the minister in the car, keeping intact the shot of a real person behind the illusion of a window.

Cyan's desire to incorporate more live action in *Riven* than in *Myst* was not meant so much to dazzle people with technology. Rather, it was that they wanted to draw players into the game more deeply by making their interactions with characters integral to the story's progress. Just as a player's powers of observation pay off in being able to figure out which objects, animals, and sounds are important when solving puzzles, so, too, do they pay off in being able to watch and listen to what the characters are doing or saying. But like the objects, the words can be riddles, too. At the beginning of the game, Atrus warns you to watch out for the conniving Gehn. When you meet him, however, Gehn acts contrite and reasonable. One of these men is clearly not being entirely truthful. But which? And in what way? This is the extra layer of complexity the video footage adds to the experience of playing *Riven*.

Tony Fryman—production manager, frisbee golfer, and (far right) occasional scribe.

This shot from an animated sequence in the Mag-Lev depot on Survey Island (right) involved carefully compositing live action and CG effects in order to produce the impression of the car turning and speeding away with the scribe visible through the windshield.

In the village schoolroom on Jungle Island the D'ni alphabet lines the walls (above) and phrases are found on chalkboards.

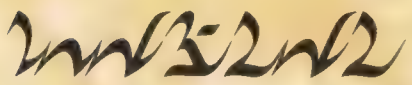
The writing at left translates as "The Rules of Gehn: Gehn is our master, Gehn created us, Gehn defeated Atrus."

D'ni Language and Writing 101

While Gehn may seem altruistic by having the village children schooled in the language and writing of the D'ni, he is, in fact, preparing them to one day write Age books for him, which he will use to quench his thirst for millions of worlds to rule. At the same time, he is subtly reinforcing his domineering control over the villagers. Most of the words and phrases taught to the children are specifically related to Riven, the jungle habitat of the villagers, and their ways and lifestyles. But there are other words he includes that refer to his obsessions, his private domains, instruments of pain and punishment, and mythic figures of death. What the children really learn is to fear Gehn and to obey him. The Wahrk Gallows toy, used to teach the children the D'ni number system, is a grim reminder of what happens to those who choose not to. Following is a selection from Gehn's D'ni Primer, including the word in D'ni, its phonetic equivalent, and a basic definition of the word and what it relates to:

vaht

The word "five." With Gehn's obsession with the number five, it's not a surprise that it is the first word in his primer.

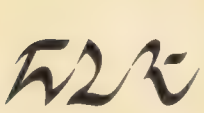


ter-pah-rah

Literally "Great Tree." This is the name of the large trees that grow on Jungle Island.

yer-tis

This is the name for a small plant of Gehn's Fifth Age. Its yellow berries contain a neurotoxin, which the villagers use when hunting for food.



dash

The Dome Towers. Gehn warns the pupils not to approach his fire marble domes.

mahn-shooth

"The one who brings death." The "Grim Reaper" of the Fifth Age. Legend says that anyone who sees the "Death Bringer" will die before the sun sets that day.

heek

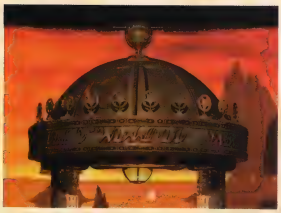
Gehn's cane is known by the villagers to be a weapon of death. Gehn puts this word in the primer to remind the kids who's boss.

uhg-raht

The name of the pillars in the Wahrk Lake. Villagers are hung from these pillars and fed to the wahrk as a form of punishment.

The Basics of D'ni Grammar

(research by Richard Watson)



D'ni writing is found in many places in *Riven*, including inscriptions on the canopy of Gehn's writing desk (above).

D'ni is not an Earth language, but because the D'ni are so similar to humans physically and mentally, their language has similarities to some of our native tongues.

D'ni is often compared with Hebrew, since the two languages have similar characters and sounds. But there are many differences, with the most obvious one being that D'ni is written left to right, unlike Hebrew.

The D'ni alphabet has 24 characters, but there are more than 24 consonants. These are created by adding indicator marks to a letter. For instance, the character for a "v" sound is the same as the character for a "b," only the "b" has a dot over it. Generally, any consonant without a dot is a fricative, meaning it's produced by air passing continually between the tongue and lips. A consonant with a dot over it contains a stop, meaning that the air is cut off. In the case of a dotted "v," the air is stopped by the lips. By adding indicators to their vowels, D'ni's six vowel letters are expanded to eleven vowel sounds in their spoken language.

D'ni follows a familiar noun-verb structure. Adjectives follow the nouns they modify. Adverbs follow the verbs they modify. Quantifiers such as "very," "extremely," and "really," which add emphasis to phrases, are indicted by numbers from one to twenty-five. The higher the number, the stronger is the emphasis. For example, the phrase "I am a little tired" in D'ni becomes, "I am tired to two." "I am very tired" would be, "I am tired to twenty." To exaggerate something, the D'ni would use a number over twenty-five. "I am incredibly tired," in D'ni could be written or spoken as, "I am tired to thirty."

There are a number of important prefixes and suffixes in D'ni. Verbs use a suffix to indicate both number and person (this is similar to Spanish). For example, the D'ni word for eat is "rees," which is the form it takes when you say "I eat." The suffix "en" is added to indicate that he, she, or it eats, "rees-en." "They eat" uses the suffix "eet," "rees-eet." "We eat" uses "et," "rees-et." "You eat" (singular) uses "em," "rees-em." "You eat" (plural) uses "tee," "rees-tee." You can change this phrase to a command by adding the additional suffix, "ah." To order an individual to eat, you would say, "rees-em-ah!"

On Survey Island the base of the Map Room is adorned by D'ni writing carved directly out of the metal shell of the domelike structure.

Verbs use a prefix to indicate the past, present, and future. To say that you have finished eating, the phrase is "ko-rees." To say that you are currently eating, the phrase is, "do-rees." To say that you will eat later, the phrase is "bo-rees." Other forms of the suffix are:

kodo (past progressive): kodo-rees (I was eating)

le (perfect): le-rees (I have eaten)

kol (past perfect): kol-rees (I had eaten)

bodo (future progressive): bodo-rees (I will be eating)

boko (future perfect): boko-rees (I will have eaten)

bodol (future perfect progressive): bodol-rees (I will have been eating)

Other common prefixes are "re" for "the." The D'ni word for "book" is "kor," so to indicate "the book," the phrase is "re-kor." The word "and" is "ga," so to indicate "and the book, you would say "ga-re-kor."

Suffixes can indicate ideas such as plural and possession. To make a noun plural, add "tee" to the end. The word for "books" is "kor-tee." To indicate possession, add the suffix "okh," which roughly corresponds to "of." The phrase "Gehn's book," in D'ni is structured, "book of Gehn," and is written, "kor-okh Gehn."

An adjective, such as "garo" ("mighty"), can be changed to a noun with the suffix "th," as in "Garoth" (Mighty One). You can change the same adjective into an adverb with the suffix "sh," "garosh," as in "mightily."

There is also a special set of characters called the "Garo-hevtee," "Great Words." These symbolize important ideas of groups of words.

Rendering

As far as the computer is concerned, everything designed by *Riven*'s creators—the objects, landscapes, animations, textures, shaders, and lighting effects—are just a bunch of programming equations. What turned all of these numbers into the state-of-the-art graphics a player sees when he slots the game disk into the computer drive is the software that "rendered" each image pixel by pixel. Rendering is not to be confused with actually "creating" the image, since all of the work of designing models and coloring, texturing, and lighting them being done by the CG artists is what adds up to the final image you see. "Rendering," says Josh Staub, Cyan's CG production director, "is simply our saying to the computer, 'Okay, show me what it looks like.'"

Rendering is nothing more than a computer command to "show what the image looks like" on screen. Considering how long it could take to render some of *Riven*'s gargantuan shots, section by section (above), it was also a good time to make some phone calls or eat some lunch.

And this is where it could get very frustrating, since rendering each of *Riven*'s 4,000 images—every single one with that RAM-wrenching, time-chewing option called ray tracing—often became an exercise in computer Russian roulette, never knowing which file might be sent down the rendering queue only to be shot down by its own internal complexities. Over the course of building the thousands of models and scenes for *Riven*, the CG artists of Cyan naturally developed an affinity for spotting the situations and problems that would be better to avoid when it came time to rendering, but it was never an easy task to strike the right balance between clean, efficient rendering design and the extreme artistic demands they put upon themselves. For Josh, "The key is to cut corners in ways that don't affect the quality of the image."

Jason Baskett

In every stage of the process, the artists resort to "previewing" as a way to view a model or a textured polygon without actually having the computer render it. In this way, they could move as fast as possible, making quick edits and tweaks before choosing to render that particular stage of the shot. If they were working with an object, they didn't bother including the setting behind it until it was necessary. And if the resolution appeared low and the edges of things a little jagged, they knew it would be crunched up later when, in the final stage of rendering, anti-aliasing is applied. Along the way, the artists maintained a close eye on the problems that might be developing in a scene. While in certain cases the software itself threw in its own bugs, it was usually a case of too many polygons or textures—or a combination of several things—in the shot. When Jason Baskett was modeling and constructing the jungle scenes, he had to deal with an enormous amount of

geometry, often well over a million triangles or polygons per shot. Says Jason, "Some scenes were so large that simply opening them would take as long as forty-five minutes. In fact, for each shot, I would have to hide every object that wasn't seen in the frame. Otherwise, the computer would not have been able to render them."

Perhaps the most grueling situation, however, involved the choice to ray trace every image. When the computer has to trace the paths of light through, around, and off of objects, accounting for the effects of refraction and reflection, the possibilities can approach the absurd and perhaps doom the image to a never ending hell of trace time. Gehn's desk in his office, for example, has a number of glass props on it. While the artists chose to drop a bone stirrer into the glass of liquid—and have the computer render the refraction effect—they stopped at having the two glass objects overlap each other. They are separated, in fact, by the merest fraction of an inch. Overlap the glasses and the light would have to be traced through the glass, through the liquid, through the back of the glass, through the second glass, through the liquid—(stop!). There are, it seems, limits as to how far even Cyan was prepared to go to make *Riven* look as spectacular as it does.

Gehn's writing desk (detail above) would probably have died in the rendering stage if the designers had chosen, arbitrarily or not, to place one glass in front of the other, requiring massively more computing power to ray trace the light paths properly.

In the beginning, the *Riven* team thought it would create and render the whole game with the three original SGI workstations. By the end of production—after reality had settled in hard, and early—Cyan had invested in four massive SGI Challenge servers to do the rendering. With all that hardware, the process could still be painfully slow. Depending on an image's intricacy, it could take anywhere from thirty minutes to four hours to render a single *Riven* image. Toward the end, when time was running out, shots were carefully analyzed for their impact on the rendering process before they were allowed to be sent on to the servers.

In fact, the task of creating the final rendered images for *Riven* was so large that Cyan considered sending their files off to be finished at a professional "rendering house." None of the shots they sent out for testing, however, produced satisfying results. "They didn't have all the software we'd built for the project, like our custom shaders," Robyn says. In the end, rather than compromise the look of even a single frame by letting someone else handle the job, Cyan cranked up their servers, letting them cook away 24 hours a day, seven days a week, until it was done.

Sound

A unique challenge of creating an interactive fantasy world is devising sounds for places that have never been seen before and for object and things that don't exist. With *Myst*, the job of creating all the sounds for the game had fallen to Chris Brandkamp, who, with no experience designing sound effects, resorted to an assortment of "special" tools—air guns, recycle bins, straws, metal pipes, and wrenches, among others—in order to produce well over a hundred individual sounds that helped to distinguish *Myst*'s supercool ambiance. "Quite an experience," Chris recalls, chuckling at the thought that he will forever be remembered as "the toilet bubble man."

Mike Salvatori (left) and Marty O'Donnell, in addition to Broderbund's Tim Larkin (not shown), produced the soundscape for *Riven*.

For *Riven*, however, there was so much more sound needed to accomplish than in the first game. Exactly what kind of noise does a sunner make when it's stretched out on a rock? And what would be the background noise of a jungle full of metallic beetles? For these and other effects, Cyan turned to experienced sound designers from around the country. Marty O'Donnell and Mike Salvatori worked out of a studio in Chicago, while Tim Larkin was based at Broderbund in San Rafael, near San Francisco. Their collective job was to create *Riven*'s soundscape.

For Gehn's Mag-Lev car (above) Tim Larkin mixed together—among other sounds—servo, power seat, and window motors with a bunch of "clicks" and "kachunks" to bring an otherwise silent door to life. For the sound of the cage rising and lowering in Gehn's office (right), Marty and Mike used a chain on pulleys, a winch, a submarine hatch, a nail scratching a gong, and, believe it or not, a twisted scream. The elevator ride underneath Survey Island, which leads down to the so-called Lava Room (opposite), required a symphony of sounds including metal doors shutting, gears whirring, water dripping, and all the hums and echoes reflecting the enclosed environment.

There are two basic types of sounds in the game: animation and ambient. The first type accompanies the dozens of mechanical and organic animations in *Riven*—from the simple click of an elevator button or the electric hum of Gehn's Mag-Lev car to the breathing of a sunner. Ambient sounds are the noises that lie in the background of each scene. They're the sounds you may not even notice unless you're paying close attention. And that's part of the idea. The trick for a sound designer is to come up with ambient sounds that are interesting, but not distracting. And when the sounds fit the object properly, they subtly imply details hidden from view. Gears rumble to life and chains rattle when an elevator emerges from the water in the underground foun-

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If the player listens carefully as he moves through the different areas on Jungle Island—from the sunners lagoon (left) through the clearcut forest (below) to the jungle itself (bottom)—he will notice the varying ambient sounds that signal the individual mood and character of each environment.

tain room on Survey Island. And in Gehn's office, there are distinct mechanical clanks and whirs in the cage as it is lowered and raised, hinting at intricate mechanisms secreted in the floor and walls.

When done right, ambient sound, in particular, can define a landscape and establish the mood. Often, in some of *Riven*'s less populated environments, "Nothing is specifically happening to create sound. But you want to create an ambiance to make a player feel a certain way," says sounds designer Tim Larkin.

The Jungle Island, for instance, is divided into three main sound areas. There's the beach where the sunners doze on rocks at the edge of the water. There's the clearcut forest, where Gehn has had the trees hacked down to

provide paper for his book-fabricating experiments. And there's the jungle itself, luxuriant and home to a complex ecosystem. Each of the three areas is dominated by basic tones and a mood. The beach is a warm and inviting place, with the sound of waves and gentle tufts of wind. The clearcut forest is dry and harsh, dominated by a thin breeze and the brittle sound of cicadas and crickets. The jungle is the opposite, full of the lively sounds of insects and birds and warm, lush breezes. Each environment has several layers of sounds, all in repeating loops of different durations. Even if you spend a lot of time in one environment, you're not likely to hear exactly the same arrangement of sounds twice.

Often, the sounds in *Riven* are combinations of other sounds. Tim Larkin based the sound of the Survey Island elevator on the rattle of San Francisco's cable cars. He created the sunners unique bark by mixing a walrus's roar together with hippo and rhino grunts. In fact, Tim, Marty O'Donnell, and Mike Salvatori were constantly creating brand new sounds for the game. They sampled sounds from their own environments and recorded sounds from sample libraries, then used samplers and software, such as Macromedia's Deck, to digitally chop the sounds into small pieces and combine them in new ways. Most of the major sounds are made up of between 18 to 20 separate elements. Even the small sounds, such as the click of a button, can combine six to eight elements. After mixing them together, the sound designers then stretch the sound's duration, lower or raise its pitch or combine it with other sounds. This way, even an utterly ordinary sound can be transformed: Tim's son's Big Wheel tricycle becomes the subtle roll of Gehn's fire marble domes and a carpet being dragged across a table evolves into the sound of the sunners breathing. Almost none of the sounds in *Riven* were recorded straight and dropped into the game without some alteration.

"You would have heard it before," says Tim. "And that's dull."

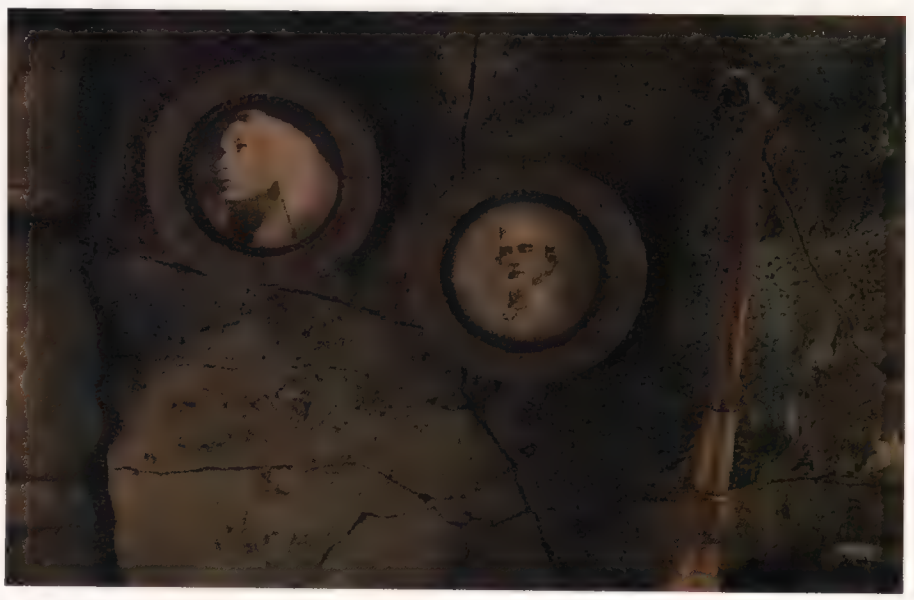
Tim Larkin

The sounds for the pot-belly stove (below) Gehn uses to fire up his Linking books in his office were created Mike and Marty by "simply" mixing metal plates scraping, squeaks from rusted handles, and gas hissing with some fireball and lava bubbles thrown in (the latter made for one very hot recording session at Hawaii's Kilauea Volcano). Even for simple objects such as a lever (below left), producing a believable sound requires an assortment of ratchets, squeaks, and scrapes.

Music

While *Riven*'s environments are defined by their look and enhanced by sound, the emotional center of each place is often revealed through music. Each of *Riven*'s settings as well as its main characters has its own theme, all composed by Robyn Miller, who used his experience as the composer for *Myst* to expand and deepen the sonic possibilities of *Riven*. In all, he created close to two hours of original music for the game.

"Usually, coming up with the basis for any of the themes is the hardest part, the part I struggle over, trying to arrive at something which is emotionally right for a location or character," says Robyn. "With an interactive world, such as *Riven*, this process is even more difficult, because the piece usually has to remain somewhat generic. It can't say anything definite about a person's character or motives. It would be much easier to tell the player (with music) that, 'The person who made this room is a really bad guy!' Instead, the music must say things like, 'Isn't this room a mysterious place? It feels both bad and good. It feels slightly tense, yet slightly calming.'"



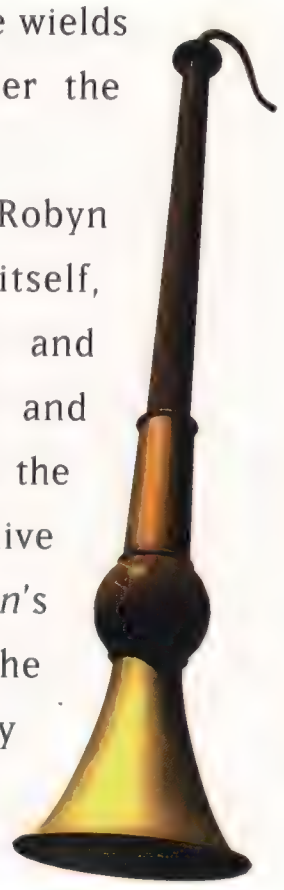
"Using one distinct instrument, I was able to effectively, but subtly, mark Gehn's territory."

Riven's defining musical motif is Gehn's theme. Originally composed for the Wahrk Throne Room, Robyn felt the piece was too strong for the location. He heard in the song something larger than any one place and ultimately decided it made a definite connection to the man who dominated Riven's world. Although you don't hear the complete song until you meet Gehn in his Age, the piece is all over the game. On the Jungle Island, for instance, the Rivenese village is represented by music that's largely percussive, yet underneath it, Gehn's theme is woven in as a sign that he wields considerable influence over the villagers.

"The Catherine music was like pulling teeth: it needed to say so much, but express nothing overtly. I finally concluded on a sort of atonal blend of organic sounds."

—Robyn Miller

For the most part, Robyn worked from the game itself, watching the animations and scenes unfold on screen and composing accordingly. For the sequences which involved live actors composited into *Riven*'s computer graphic world, he wrote using a method many composers use when creating the soundtrack for a



In Gehn's bedroom (above) one finds a trove of personal artifacts as well as his musical instrument (left), which sounds like a cross between an oboe and a soprano saxophone.

Catherine on Prison Island (far left).

"Writing music is, for me, a process of discovery. The music seems to already be there, just waiting for me to find it. When I try to 'invent,' I start writing bad music."

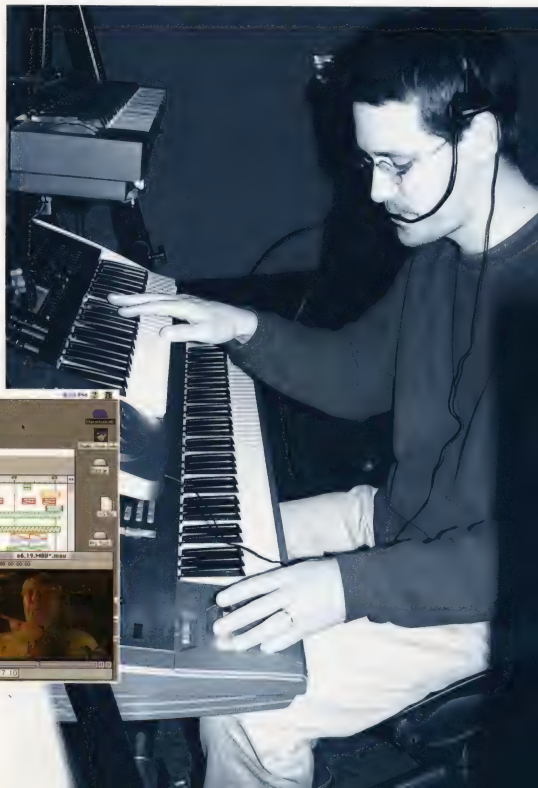
The Rebel Linking Room (above).

movie: he improvised to the action on a video monitor until he found something he liked. Then he refined that to fit the time and action of the scene.

Almost all of *Riven*'s music was composed and performed in Robyn's studio in the basement at Cyan's offices. He worked with a Korg Trinity and a Yamaha VL-1 synthesizer and Opcode's StudioVision software on a Macintosh. But, says Robyn, "my favorite instrument was the Yamaha VL-1." This synthesizer uses "Physical Modeling Synthesis," meaning that if you play a flute sound, you're not just calling up a tone which is electronically similar to a flute, but a digital model of the physical characteristics of a flute as a player blows across its mouthpiece. In fact, there's a tube built into the instrument which musicians can blow into, literally controlling the sound of the instrument with their breath, just as if they were playing a real flute.

Robyn Miller composed *Riven*'s music on a Korg Trinity (below) and Yamaha VL-1, using Opcode's StudioVision software and a Macintosh computer.

Simulating the sounds of real instruments and modifying them to a degree which results in a sound never quite heard before led Robyn to weave music into *Riven*'s story in ways that created additional layers of meaning to settings and characters. When the player arrives in Gehn's Age and begins to explore his office, he comes upon a bassoonlike D'ni instrument hanging on the wall in the bedroom. Robyn was inspired to create this imaginary instrument after producing the sound for it first. You hear the sound when you turn on Gehn's music player. And the song you hear is meant as a recording of Gehn playing this instrument. Gehn, Robyn would like us to understand, may be a brute, but he has a human side as well.



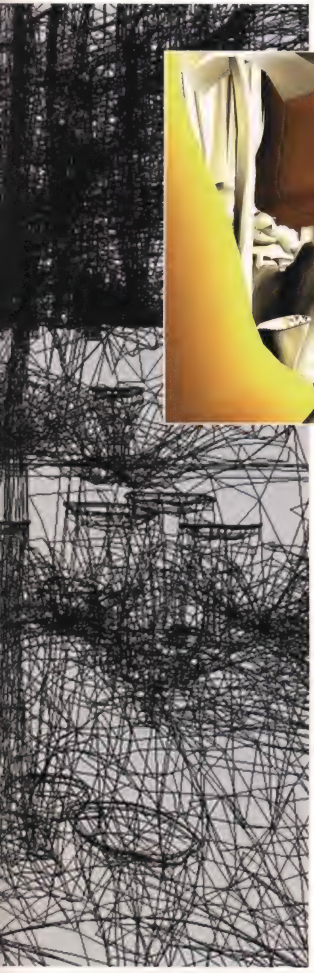
IV.

COMPLETION

World Assembly

Jungle Island, *Riven*'s largest piece of geometry, consists of nine areas the player can visit: the jungle (above), the clearcut forest, the village, the sunners lagoon, the east path, the south path, the beetle pool, the schoolroom, and Gehn's area.

Cyan calls it "World Assembly," and there is perhaps no other company on this planet where you can apply for such a job. What else would you call the task of putting together a computer game that's a megagigabyte puzzle all its own of 3-D computer images, animations, sounds, music, and video? Led by *Riven*'s CG production director, Josh Staub, the World Assemblers, as the designation implies, were responsible for reviewing all the separate elements that had been created individually—checking their integrity and technical aspects—and assembling them into massive scenes. These scenes would then have to be lit, tweaked some more, and finally rendered. This stage of the process

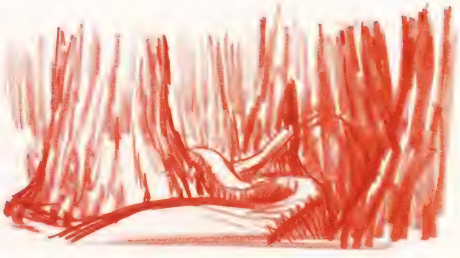


One look at the model of the jungle on the opposite page (the shaded polygon and fully rendered versions are shown top and above) suggests why the huge and intricately conceived island was sectioned off into many separate pieces in order to be designed and then rendered.

logically occurs toward the end of the production, although it began well over a year before the game was complete, as certain portions were finished before others. With so much focus on designing the separate shots themselves, it is quite a different skill entirely to then step back and visually analyze a world of shots and calibrate their relation to each other.

As Josh points out, one of the things you notice about *Myst*, if you look closely enough, is the distinct differences in visual styling from Age to Age, which reflects the fact that different artists worked on different parts of the game. While *Riven* would follow the same path—in terms of many artists designing different parts of the game—the need and desire for a world without inconsistencies and contradictions, in any form, was so much greater. What everyone had learned was what the D'ni knew only too well from their experience in writing Ages: that "contradictions

A concept sketch for a path in the jungle (below).



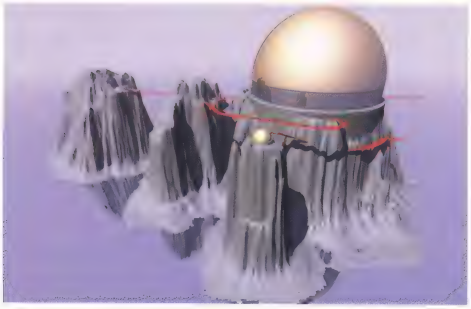
can destroy an Age. Too often they simply make it break apart under the strain of trying to resolve the conflicting instructions."

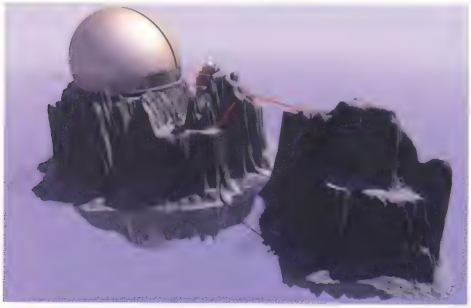
Resolving the conflicting instructions was the goal for *Riven*'s World Assemblers. With the indoor scenes, it was easier because these models were much smaller and more manageable. Outside, however, there was often a much larger view that included most of a given island or location. Or the sequence of shots might include two completely separate scenes (a scene being one part of an island, say, as opposed to another). The problem encountered here might be too much geometry, in which case a shot wouldn't render. Many of the game's models, for instance, were so large and complex that they were split into pieces early in the process in order to deal with them at all. The Temple and Jungle Islands, the biggest ones in *Riven*, remained whole only as far as the basic model with shaded surfaces and models of a few of the major objects dropped in. After that, they were chopped up, remaining that way throughout the production. Even so, some of these pieces themselves were monsters to deal with as they still contained millions of triangles and thousands of textures. *Riven*'s artists were also careful to design transitions between scenes to provide moments where, if the player turns around, a bend in the path or wall will obscure the land-

By definition World Assembly presumes there will be parts of a world, however many, that need to be assembled into a complete game. Ironically, when the process of creating these parts begins, it *is* whole but then it becomes divided in order to make modeling, design, and rendering its parts more efficient. When Josh Staub began laying out Temple Island, for example, he began with a two dimensional gray-scale map. The shades of gray, like a bump map, corresponded to the varying topography. The colors were added to help Josh keep track of different parts of the landscape that, because of gameplay, needed to be the same height.

Everything in *Riven*—from the largest island (below) to the smallest object (right)—was modeled and finished in exactly the same way—with painstaking attention to detail.

scape behind it. This way, they don't have to include the model for that landscape in the shot. In fact, they looked to create these transitions wherever possible, without it becoming too obvious.





Using SoftImage, Josh transformed the gray-scale map he created of Temple Island (opposite) into a three dimensional model (two views above) that included the main objects. To check the basic design of the island—its look, the structure, its proper relation to the gameplay—finished elements were added and the image rendered in low resolution form (right). Once checked, the island would then be chopped up into as many as 60 to 80 pieces for the artists to begin designing the detailed exterior scenes around the island.

Conversely, there were also areas where the view is so wide that a number of different shots had to be rendered and then composed to produce a single image. According to CG artist Jason Baskett, "the area surrounding Gehn's throne on Jungle Island required four different shots to be taken for every single frame the player sees." In this case, each composed and rendered image required a shot from the jungle model, the clearcut model, the pit model, and the throne model.

Quite often the problem would be an aesthetic or gameplay one. Camera angles were repeatedly checked. The color and texture of similar objects were reviewed in case the different artists working on them had chosen slightly different texture maps to apply. And lighting was examined to make sure even the most subtle changes were designed to be there and not due to error. It could be as simple as someone forgot to turn on the blue or the fill lights. When it came to changes in the gameplay itself, it was a much greater headache to keep track of all the consequences to shots, especially when different scenes might share views of an object or setting. If something was changed in one scene and could be seen from another, it had to be changed in that scene as well.

Evolution

While most companies will go outside to the general public to test their products looking for responses, Cyan, for the most part, relied on its own members to screen *Riven* and work out all the kinks. Every month, throughout the process of designing *Riven*, production meetings were held in which the main members of the team would discuss sections of the game, which they had spent some time reviewing before the meeting. Each person would come prepared with his own "gripe stack." No doubt most of the major changes that occurred to *Riven* during its development were caused by the developers themselves. The effort to relate story and character issues while designing the game resulted in a continuous refining of elements in which details were discarded because they no longer applied, made sense, or related to the situation. The consequences of these refinements, however, were not insignificant. Whole portions of islands had been designed and rendered and then dropped from the game due to some basic changes in the story. Complete objects and buildings were cut out after new developments in a character had made them obsolete. This was perhaps a price paid for their particular production approach, but a satisfying experience would probably not have been achieved any other way, and no one clung to anything, no matter how complete or special, if it no longer belonged.

When near the end Cyan would finally bring in people unfamiliar with the game, they would test it in much the same way that studios test movies: monitoring people's reactions as they went through the experience. In their case, the audience was usually people they knew from *Myst*'s testing days. Cyan was most concerned with the story and visual content of the game and with ease of understanding one's way around. To start, one of Cyan's team, often Rand or Richard, would set up their tester with a working copy of *Riven* and watch from behind as the person played. "We would take notes as they went," explains Rand. "We wanted to know what works. What engages them? What do they miss?" The smaller stumbling blocks that popped up were usually dealt with easily during the test. For example, if a player clicked on a certain spot in order to move forward but nothing happened, it was clear that the "hot spot" wasn't large enough and others might have the same problem.

For a variety of reasons, but all having to do with the evolution of *Riven*'s gameplay design, there were a number of concepts for rooms—including an early version of Gehn's lab (top) as well as a room for the elevator on Survey Island (above)—that went through major design overhauls due to changes in the story or character development.

Since Rich Watson and Ryan Miller programmed *Riven* in Hypercard, it was a simple matter to punch a few key strokes to call up the particular stack for that shot, make the adjustment, and resume the game.

The biggest concern was seeing where players went off-track or became frustrated with the puzzles. After each testing session, the team would compare notes and discuss whether any changes were necessary to accommodate what they'd observed. It was important to see any problem occur repeatedly with different testers before Cyan contemplated going back for major revisions to the gameplay. They had already spent years developing it, reviewing and refining it, so everyone was fairly certain the game was close to being complete. But just in case a problem with a puzzle, for instance, did come up and could not be ignored, there was usually a simple option. The best place for adding information and clues to help the player solve puzzles were the various journals discovered lying about throughout the world. In *Myst*, the very first note you find lying on the ground on the path near the planetarium was never there until just before the game was released and it was clear testers were having problems figuring the tower rotation conundrum. Dropping notes around and adding clues into journals allowed for the maximum amount of information to be conveyed with the least consequences, and certainly avoided having to go back in and restructure the puzzles themselves.

Ryan Miller

Gehn's Effigy

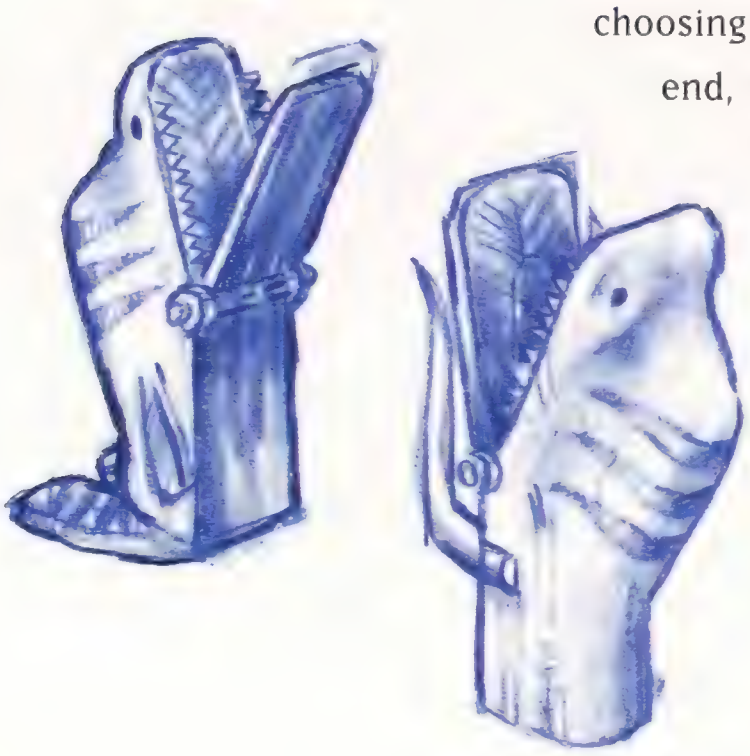
In designing *Riven*, Cyan went to extraordinary lengths to accommodate every conceivable move players might choose to make, including the possibility of their wandering back to places already visited. A game that did not reflect the whims, as well as the logic, of the real world would seem incomplete, as if doors to rooms had been built but the rooms forgotten. But merely allowing the player to return to locations wasn't enough. In certain cases, events that occurred the first time would make no sense if they occurred again. Linking to the Rebel Age is one of those instances where the first time the player approaches Gehn's effigy (above), he is darted by a hidden rebel and hauled off to a cell. From there the game continues and the player makes his way back to Riven. But if the player decided to link again to the Rebel Age—perhaps just to check out once more some of the wildest images in the game—he is free to examine the effigy, which has some interesting details the player will never understand but which *Riven*'s designers thought of nonetheless. Festooned along its sides, like the metallic feathers of some primitive bird, are the Moiety's signature knives—their calling cards. Each knife represents a rebel who has died in the struggle to defeat Gehn. In the effigy's hands is a Linking book, on top of which lies the "focuser," a device made from a special crystal that Catherine wrote into the Rebel Age. Since Gehn's Linking books need power to operate properly, the focuser was designed to make the book work without all of the tyrant's clumsy equipment, allowing the Rebels to link back to Riven.

On these pages are the D'ni symbols for the numbers one through ten.

A view of the Wahrk Gallows on Jungle Island (left).

Puzzles & Payoffs

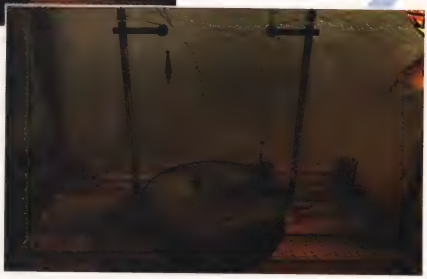
To produce a satisfying ending for *Riven*, the creative team had to devise not just a coherent story for the player to follow, but a series of puzzles that escalated with the narrative, while also fitting seamlessly into it. "A good puzzle doesn't feel like a puzzle," explains Robyn. "A good puzzle should be perfectly melded into the world and into the story. It should be invisible and intuitive at the same time it should not be a chore. A bad puzzle was the maze in *Myst*."



The problem with the maze encountered in *Myst*'s Selenitic Age was that its solution was based on matching sounds to their corresponding directions, not on mapping out all the possible routes until the right one was discovered, as most players believed. But in a labyrinth, choosing a path based on sound isn't an obvious or intuitive answer. In the end, what was supposed to deepen the experience of the game became an exercise in frustration. In *Riven*, the puzzle masterminds were careful to a fault to avoid this predicament. Rather than create a series of disconnected challenges that eventually led to the conclusion of the game's mystery, they carefully constructed a web of riddles that interrelated story with settings and characters. This web was then spread across Riven's five islands and the player thrown into the middle of it.

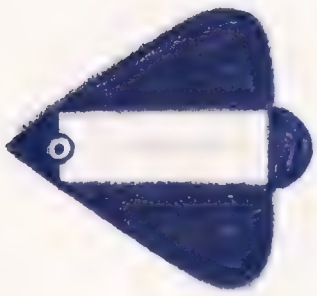
One of the game's main mysteries involves deciphering D'ni number symbols. Do this and all of *Riven*'s other major puzzles become

Where else would you learn the D'ni number system besides a school? The number toy is visible sitting on a table in the left of the image of the village schoolroom (above).



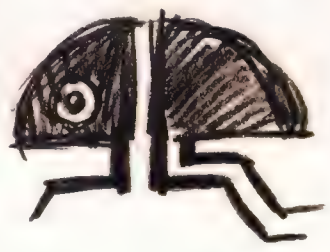
True to Gehn's cruel nature, he has reinforced the power and brutality of his rule over the villagers by basing the design for the number toy (in concept sketch on opposite left and above and right in final form) on his favorite method of punishment—the Wahrk Gallows.

solvable: accessing the Rebel Age, opening Gehn's fire marble domes, and releasing the lock under the telescope on the fissure plateau. The symbols are learned in *Riven* not by reading them in some journal left for the player to find, but by having the player interact with a diabolical child's game found in the villager's schoolroom on Jungle Island. Based on one of Gehn's preferred methods of commanding obedience—feeding troublemakers to the wahrks—the small wooden device can be operated to lower a tiny figure into the jaws of a toy wahrk. The D'ni number symbol that appears on the side of the toy corresponds to the number of steps closer to oblivion the hapless wooden victim falls. In this manner the symbols for the numbers one through ten are learned. What is discovered later, however, is that certain puzzle codes that have to be cracked are based on numbers higher than ten. The player will have to determine for himself what combination of symbols make up those numbers.



Around Jungle Island the player finds these small carved eyes that rotate to reveal a number written in D'ni (right). It's up to the player to figure out which animal is connected to that number.

Armed with the knowledge acquired in the schoolroom, the player can make sense of the puzzle related to the different fauna encountered on Jungle Island where the villagers live. Wandering around, the player will find five small revolving orbs with eyes that reveal a number, written in D'ni of course, on the back of each. Alone the numbers mean nothing, but what the player has to observe is that in the area of the orb is a clue to a corresponding animal. The clue is usually in the form of the animal's shape, which is subtly woven into the surroundings. There is one, however, that relates to the sound you hear in the area of that particular orb, and this is perhaps the hardest hint to catch. It's not only a question of paying close attention but of having heard the sound before and being able to identify it. If the player



On this page are various concept sketches for the symbols of animals that populate Jungle Island. Discerning the hidden shapes or presence of these animals in the settings around the island (left) is part of the puzzle guarding the Rebel Age.

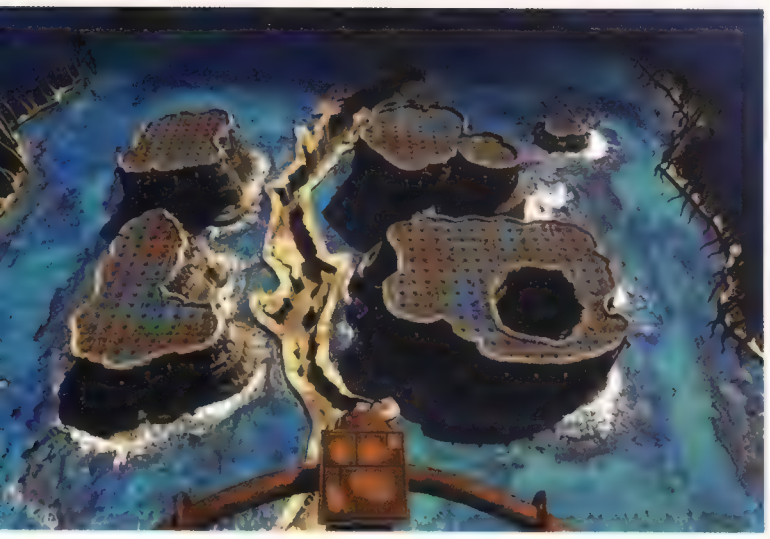
has come upon the sunners lagoon and met these strange creatures, then the clue can be understood. But this is where *Riven*'s creators have once again made the game reflect real life. Those sunners are sensitive animals and will disappear in a flash unless they are approached with caution. The first time the player appears at the lagoon, he will no doubt bumble forward and frighten the sunners away. He will have to go off somewhere and then make his way back to see if the sunners have returned. If the player never approaches close enough, he will miss a critical piece of information.

Once you have gathered all the clues to the animal puzzle and the rebel tunnel has been found, it is possible to access the Linking book to the Rebel Age. It is there the trap book that was mysteriously stolen from you at the start of the game is returned. And you definitely want this book if you plan to meet up with Gehn in his Age. Getting your hands on the Linking books to Gehn's Age is, perhaps, *Riven*'s ultimate challenge.

Once inside the rebel tunnel on Jungle Island, the player is confronted by a ring of columns, each bearing a different animal symbol (above). Press the right symbols—in the right order—and the watery force field guarding the stone vault dissipates to allow access to the Rebel Age book (left and below).

The Prison Island fire marble dome (above), one of *Riven*'s five small domes protecting Gehn's Linking books. From an overlook on Survey Island (left), a layout of the five islands can be seen.

At the heart of the puzzle involving the fire marble domes distributed over Riven's islands is the game's great stumper, dubbed "the waffle iron" by its creators. Just to get access to the waffle iron, you have to solve another of *Riven*'s puzzles: a color conundrum that draws you all over the place in search of clues. In keeping with Gehn's obsessive nature, the key number in *Riven* is five. It's in Gehn's crest, which resembles a five-pointed star, in the number of islands in the game, and even in the number of letters in the game's name. What you will also quickly observe—and be drawn to—is that there are five metal domes in *Riven*, one on each island. Each rusty globe has a corresponding color, which is seen on a revolving symbol built onto the surface of each dome. The significance of this simple collection of colors isn't obvious until you've passed successfully through the Gate Room and gained access to Gehn's massive golden fire marble dome on Temple Island. There lies the waffle iron.

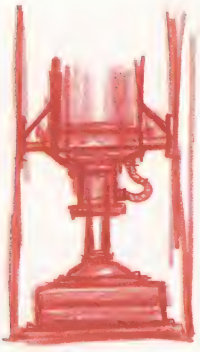


Entrance to the Map Room on Survey Island (below).

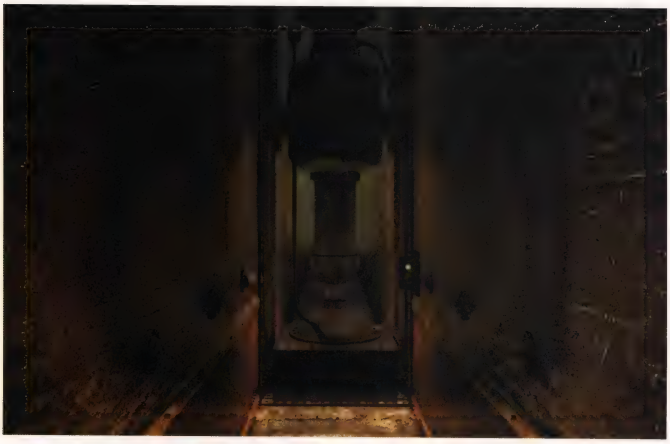
The puzzle was named for its shape and function. A metal plate attached to a giant piston clamps down on top of another plate. These plates have grids with round slots, similar to the dimples on a waffle iron. In order to get the device to work properly, you have to place five out of six available colored marbles in the correct slots on the bottom plate. The slots number 25 by 25 for a total of 625 positions and over 93 trillion possible combinations. On first impression, the puzzle seems impossible, but if you've paid attention, it's flawlessly logical.

Riven has five domes and each dome has a color. Knowing that gives you the correct set of marbles. But where to put them? Gehn's Survey Island provides a clue to the answer. From an overlook on this island you can observe a rough map depicting all five islands. You will notice—but not until you've encountered the waffle iron—that the map corresponds to the shape of the grid in the iron. Each island in the map has been subdivided in a manner that is also reflected in the grid. The key point is determining the position of the domes on each island, which is learned by a different means. Place the right marbles in the correct slots representing these positions and you will have, essentially, thrown the switch. The power in the large dome will be activated, which in turn channels energy to each of the smaller domes.

Inside the Map Room (above), the player can examine 3-D maps of each island to discover an important clue to solving *Riven*'s master puzzle.

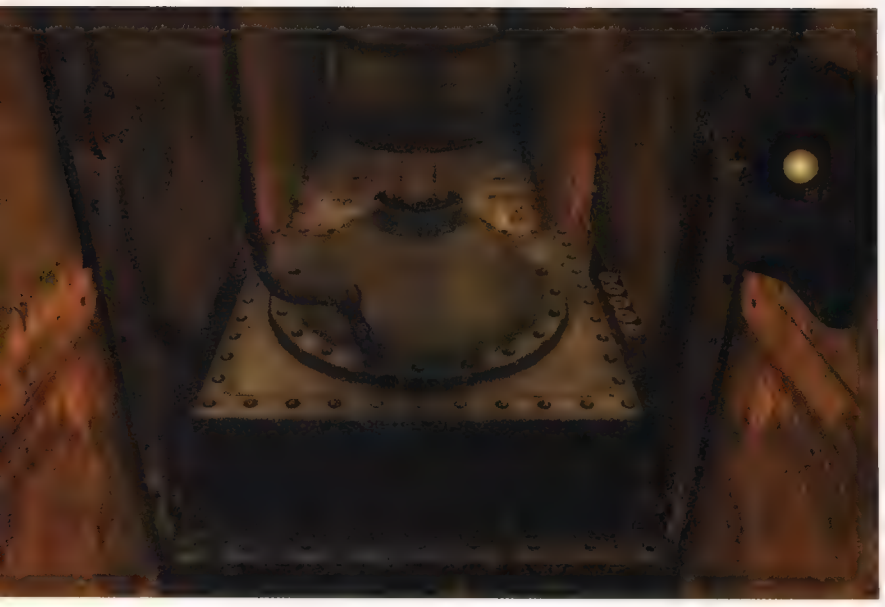


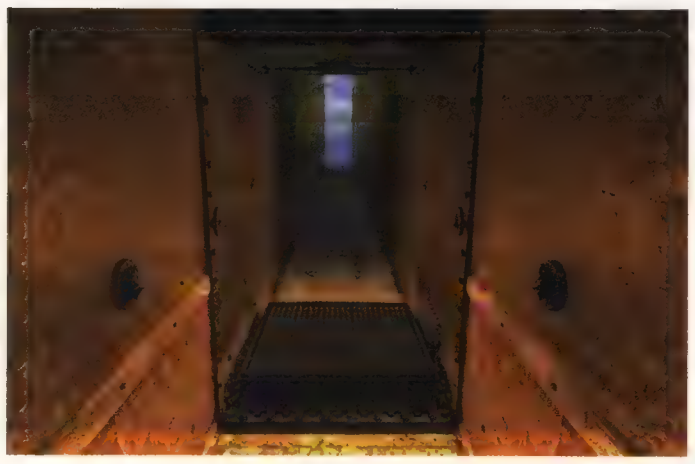
The "waffle iron," in concept sketch above, is housed in the superdome on Temple Island and is approached down a narrow passage (left).



Had Gehn built his Ages from structural principles, they might have been different, for it was possible that in so doing he might have reconciled the gaps. As it was, his method was piecemeal and the flaws that resulted quickly compounded into a complex network of interrelated faults—faults that could not be tackled by simple solutions.

—from Myst: The Book of Atrus





The walls on the sides of the waffle iron are inscribed with the various motifs from Gehn's crest, including the number five—a subtle reminder that only five of the six marbles are needed to solve the puzzle. The closed device (above) and the fire marble grid revealed (right).

The domes require power for a particular reason: Gehn is a lousy writer. His Linking books, which are hidden in the domes, don't work on their own, so in his usual blunt way, he's come up with a hack to force them to work: raw energy. Once the domes have been powered up, it's still necessary to unlock them using a code that is found in a journal somewhere on Riven, and this cannot be done unless the D'ni number symbols have been learned. If you can open the domes, you will not only be able to access the books that

A 25-by-25 slot grid (above), six marbles, and a whopping 93,850,000,000,000 possible configurations confront the player who, if he has been paying attention throughout the game, should know exactly which marbles to choose and where to place them on the grid. If he succeeds, then Gehn awaits him in his Age (below).

transport you to Gehn's Age, where you finally meet the man who rules this world, but you will have solved the game's central puzzle relating to every smaller poser, mystery, and character quirk you've encountered in your wanderings.

But if you think that is the end, then Cyan says guess again. Reaching Gehn's Age is merely the setup for *Riven*'s finale, which can involve three possible scenarios, not all good. Each one requires the player to return to the fissure plateau and open the combination lock under the telescope. Once again, the code is in D'ni and is found somewhere on Riven. With these endings, the creators of *Riven* have made sure their fans, after the many bleary-eyed hours it took to get there, would not be disappointed. And just in case anyone thinks he can figure out this final code and reveal it to others by, say, posting it on the Internet and blowing *Riven* for everyone, then the Millers have thought of that, too. Every new game of *Riven* will generate a different combination code. If you want to discover those endings, then you'll just have to play the game.

The office in Gehn's Age (above and opposite), his sanctuary from Riven. The rooms, including the bedroom (not shown), are among the most richly detailed of *Riven*'s interior scenes, providing insights into Gehn's character that suggest he is perhaps slightly more than the demented god-of-his-own-creation he appears to be.

A Game for the Ages

Now that *Riven* has hit the shelves, the ante has been raised on computer games across the board. Like *Myst* four years before it, *Riven* breaks new ground in the thoroughness of its vision and the extravagant devotion that its designers gave to its completion.

Riven is something of a text book on how to make a successful game. It takes time, imagination, and money, of course, but it also requires drive and vision—and even the madness to let that vision take you where it wants to go. In the case of *Riven*, Rand and Robyn Miller, Richard Vander Wende, and the rest of the Cyan team chased their vision across four years of dreams, wrong turns, rendering problems, system crashes, and simple hard work.

Riven isn't the end of the story. Though the game sets new standards for the rest of the competition, so did *Myst* when it came out. As sexy and sophisticated as that first game appeared, it seems a bit crude now in relation to its sleek, younger sibling. Someday, something will come along to make *Riven* look dated—probably something from Cyan itself. But that doesn't alter the fact that *Riven* is a singular moment in computer game development. All games involving imaginative worlds will be measured against it.

Most will come up way short. How many of them will have been visualized as deeply? How many will feature the quality and imaginative use of sound and music? How many will develop a fully functional alphabet, language, and number system to be incorporated into the game?

It's clear that part of the strength of *Riven* comes not just from the skill and integrity of the artists who worked on it. *Riven* is the result of a process. Like the D'ni, the Millers and the Cyan team have dreamed a small universe and conjured it into being by imagining the thing and writing it down. Like the D'ni, they walked the path that led to their dreams becoming real, even if the process wasn't the easiest, fastest, or most logical. They worked as artists, not as programmers or game hackers, and it shows in each frame.

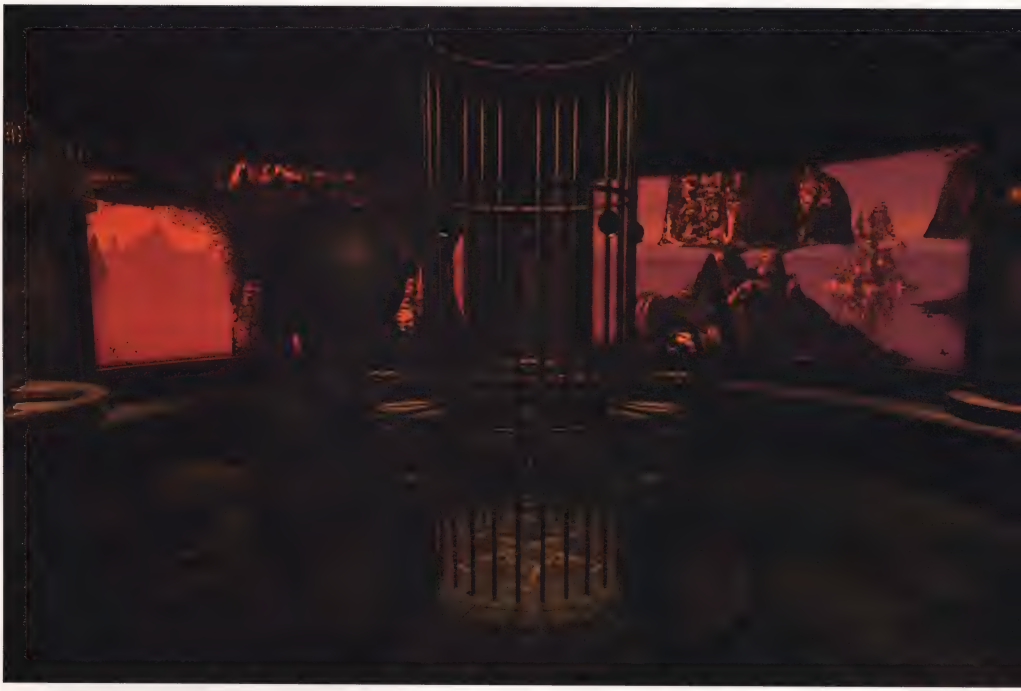
As Rand Miller humbly says of Cyan, "We make links to other worlds."

Do they ever.

Behind the throne was a large free-standing screen, on the pale linen silk of which was embroidered the silhouette of a man. That silhouette, with its high, domed head and its familiar lenses, was unmistakable. It was Gehn.

Atrus nodded to himself at this evidence of Gehn's presence. On how many other worlds had his father built such temples? In how many Ages was that man a "god?"

—from Myst: The Book of Atrus



In a rare moment, when not at their computers banging away, all of Cyan's creators, inventors, craftsmen, assistants, and disk golfers gathered under the sun on the company's back patio. Notice all the smiling? This particular day happened to be "Movie Day," a special occasion when everyone at Cyan would shut down and go see the latest special effects blockbuster.

RIVEN CREDITS

Designed and directed by **Robyn Miller** and **Richard Vander Wende**

Produced by **Rand Miller**

Production Manager: **Tony Fryman**

Lead Programmer and D'ni Historian: **Richard A. Watson**

CG Production Director: **Joshua A. Staub**

CG Artists/Animators: **Jason Baskett, Michael Bostick, Tony Davidson, Jeremy Engleman, Robin Higgin-Foley, Robert Grace, Tim Greenberg, Joshua A. Staub, Bret St. Clair**

CG Technical Director: **Karl Stiefvater**
Shaders by Lume, Inc.

Additional CG Animation: **Patrick Faille, Eric Vignola**

Compositing and Additional World Assembly: **Michael Sheets**

Effects Programming Engineer: **Mark DeForest**

Post Production Engineer and Additional Programming: **Ryan Miller**

Gameplay Design: **Rand Miller, Robyn Miller, Richard Vander Wende, and Joshua A. Staub, Richard A. Watson**

Sound Design: **Tim Larkin**

Sound Design and Live Action Foley and Mix: **Martin O'Donnell, Michael Salvatori, O'Donnell/Salvatori Music,** Chicago, IL

Music composed and produced by **Robyn Miller**
Music Sampling Engineer: **Chris Brandkamp**

Live Action Segments written and directed by **Richard Vander Wende** and **Tim Greenberg**

Gehn: **John Keston**
Catherine: **Sheila Goold**
Atrus: **Rand Miller**
Nelah: **Christine Steel**
Gehn's Guard: **Vicente Ramos**
Moiety Prisoner: **Ernie Whitecloud**
Leira (Keta): **Kate Vander Wende**
Village Boy: **Micah Biggs**
Gehn's Scribe: **Tony Fryman**
Girl in Jungle: **Sydney Wakan**
Moiety Scout: **Ryan Miller**

Live Action Filmed by **PVR**, San Fransisco, CA

Voice-Over Talent
Catherine: **Rengin Altay**

Assistant Production Manager: **Bonnie Staub**

Systems Administrator: **John Biggs**

Additional Production Management: **Dennis Leahy**

CG Technical Assistant: **Eric Arnold**

All journals (except Catherine's Journal) written by **Richard Vander Wende** and **Tim Greenberg**

Costume Designer: **Catherine Hunt**

D'ni Background Model (from *Myst*): **Chuck Carter**

Gate Room Illustrations: **Richard Downs**

Gehn's Age Sky: **Matte World Digital**

Wigs: **Joyce Degenfelder**

Costumes made by **Kauffman—Davis Studios, Seattle Opera**

Prop Construction: **Seattle Opera**

Additional Props: **Gaye Gardner, Robert Bovil, Cour Dain, Joseph Fisher, Studio 7**

Casting Assistants: **Ryan Miller, Belinda Hunt, Kinslee Miller**

Additional Cyan Support: **Chris Brandkamp, Al Carlson, Heather Ferguson-Gady, Byron Heinemann, Belinda Hunt, Mark Klammer**

Thanks to:
Everyone at Brøderbund, especially Dennis Leahy and Laurie Strand
Everyone at Sunsoft, Inc., especially Mr. Masami Maeda and Mr. Kiharu Yoshida
The original Myst team
John Miller/Symplex Systems
Kass Kapsiak
Rhode Island Historical Society
The City of Santa Fe, New Mexico
Net-Tel/Wes Morris

Extra Special Thanks to:
The Cyan team. Your efforts have been superhuman. Thank you for caring about this project!

The families and loved ones of everyone closely associated, for living through the deadlines with us.

Extra, Extra Special Thanks to:
Debbie, Kinslee, Kerryn, and Kara Miller; Beth, Alexander, Grace, and Abraham Miller; and Kate, Helen and Evie Vander Wende. "We love you and couldn't have done it without you!"

Robyn and Rand would also like to thank their parents, Ronald and Barbara, for their remarkable emotional and spiritual support and for their unfailing love.

And Richard would like to thank Garry and Evelyn (his parents). "I owe everything to you (but don't worry, I'll pay you back some day)."

PVR CREW
Director of Photography: **Steve Kotton**
Live Action Production Manager: **Renee Jensen**
Assistant Camera: **James Pusch**
Gaffer: **Mike Van Dine**
Grip: **Alex Robinson**
Ultimatte Operator: **Sprague Anderson**
Audio: **Robert Tachories**
Videotape Operators: **Wayne Cory, Jeff Piccinini**
Make-Up: **Nancie Marsalis, Joeann Edmonds**
Wardrobe Assistant: **Pamela Buss**
Live Action Continuity: **Pat Burke, David Van Woert**
Video Tape Editor: **Michael Albanese, Aldo DiVergilio**
Assistant Video Tape Editor: **Vince Oresman**
Digital Video Capture: **J. Anthony Ruffo, Derek Gatlin**
Operations Manager: **Steve Manke**
Post-Production Coordinator: **Laurie Lamson**

Voice over Engineers: **North by Northwest Productions**

Additional Sound Design for O'Donnell/Salvatori Music: **Paul Heitsch, John Binder, Mark Devos, Brian Jennings, Sean Richards, and Jeff Krajewski** (courtesy of **Fuse Music and Design**, Chicago, IL)

BRØDERBUND DEVELOPMENT TEAM
(Macintosh and IBM Platforms)
Senior Production Manager: **Dennis Leahy**
Production Manager: **Matt O'Hara**
Executive Publisher: **Laurie Strand**

Application Programmers
Lead Programmers: **Ben Ceschi, Allan Young**
Programmers: **Ed Rose, Frankie Ford, Samir Ramji**
Programming Directors: **Jeffrey Charvat, Grace Kim**

Tools Programming
QuickTime Programmer: **Mike Foulger**
Systems Programmers: **Glenn Axworthy, Scott Henderson, Bob Gulian, Michael Zacks**
Production Tools Programmers: **Esteban Ahn, Andrew Kay, Peter Van Gorder**
Installer Programmers: **Kent Daniels, Fred Campbell**
MMX Programmer: **Davis Frank**

Sound Processing: **Brian Walker**
Additional Sound Processing: **Ralph Marsh**

Special Effects Masking: **Hendryk Lasak**
Additional Special Effects Masking: **Sue Roehm**

SUNSOFT DEVELOPMENT TEAM
(All Other Platforms)
Product Manager: **Shigeki Shimizu**
Chief Designer: **Yumiko Ueno**
Programmers: **Masahiro Imaizumi, Takashi Nakata**
System Engineer: **Akihiro Asada**
General Manager: **Kiharu Yoshida**
Special Thanks: **Masami Maeda, Shizuya Furukawa, Masato Kawai**

To a casual eye it might have seemed that nothing there was real; that every object trapped within that cold, unfeeling glare was insubstantial—that projection of some dark, malicious deity who, on a moment's whim, might tear the pages from the book in which all this was written and, with a god's indifference, banish this all into the shadow.

—from Myst: The Book of Atrus

FPT $45.00
CANADA $61.00

When Rand and Robyn Miller decided to create *Myst*, a CD-ROM game featuring a visually entrancing world and a non-violent, cunningly devised labyrinth of a story for players to get lost in, they figured their main reward would be a job well done. They had no idea that it would make history as the most successful multimedia computer game ever sold. Now, with the release of *Riven*—the sequel to *Myst*—eager fans old and new will be astounded to see the Millers' latest creation—an even larger and more staggeringly beautiful world that storywise carries on where *Myst* left off.

In *From Myst to Riven: The Creations & Inspirations*, these fantasy game worlds are brought to life in a way that has never been seen before. Rand and Robyn, in addition to *Riven*'s entire creative team at Cyan, Inc., have opened their doors—and minds—to allow a unique behind-the-scenes look at the making of a phenomenon. Including insights into story development and D'ni mythology and featuring every stage of visual and technical development, as well as the cutting-edge computer graphics that are seen in the games, *From Myst to Riven* illuminates in rich detail the inner workings of the inspired minds responsible for what critics have called a "contagious . . . multimedia sensation."

Rand and **Robyn Miller** are the founders of Cyan, Inc., an independent software company located in Mead, WA. In addition to *Myst* (1993) and *Riven* (1997), Cyan has produced several innovative children's computer programs: *The Manhole* (1987), *Cosmic Osmo* (1989), and *Spelunx* (1991).

Richard Kadrey has written about emerging technologies for *Wired* magazine, *The San Francisco Chronicle*, and for the *Whole Earth Software Catalog*. He is the author of *The Covert Culture Sourcebook* and *Covert Culture* 2.0. He is currently developing an internet-related project for MS-NBC.

11/97

ISBN 0-7868-6365-X
54500>
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Produced by Welcome Enterprises, Inc.
Printed in Japan